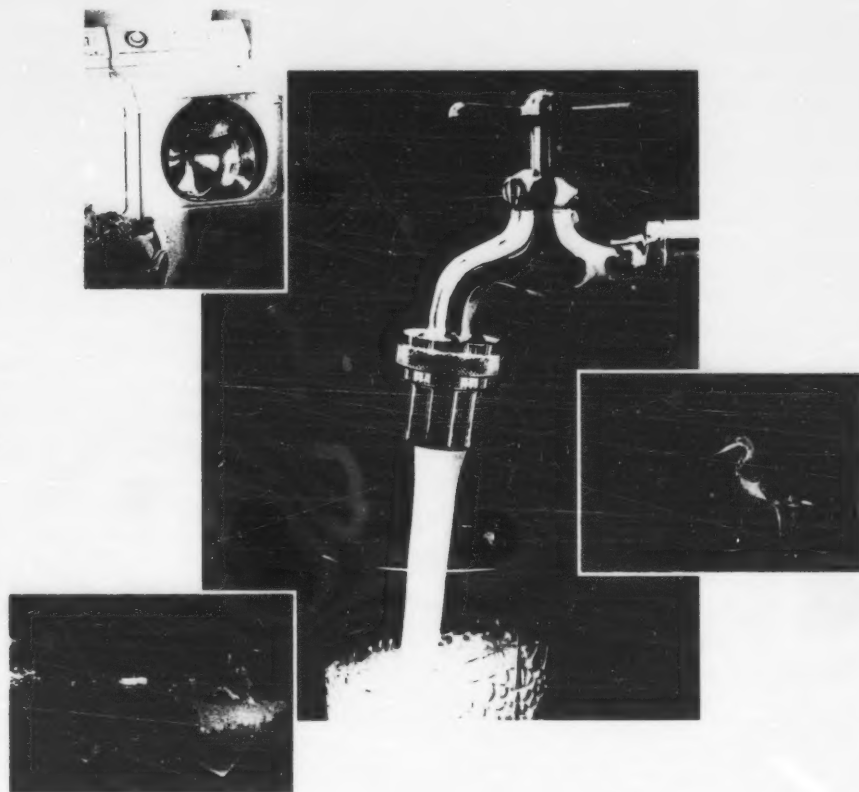


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HOUSEHOLD GUIDE

TO WATER EFFICIENCY



HOME TO CANADIANS
Canada

CMHC — HOME TO CANADIANS

Canada Mortgage and Housing Corporation (CMHC) is home to Canadians. In everything we do, we help Canadians live in safe, secure homes.

As the Government of Canada's national housing agency, we play a major role in Canada's housing industry. CMHC develops new ways to finance home purchases. We encourage innovation in housing design and technology. Our mortgage loan insurance helps Canadians realize their dream of owning a home.

Canadians benefit from our work with public, private and not-for-profit partners to improve the quality, accessibility and affordability of housing everywhere in Canada.

CMHC assistance helps low-income and older Canadians, people with disabilities and Aboriginals live in decent, affordable homes. We create jobs for Canadians with products and services that help the housing industry export its knowledge and skills to other countries.

CMHC's leading-edge research improves the quality and affordability of housing. To help Canadians benefit from our housing expertise and make informed decisions, CMHC has become Canada's largest publisher of housing information. We also have Canada's most comprehensive selection of information about homes and housing.

Canadians can easily access our information through retail outlets and CMHC's regional offices.

You can also reach us by phone at
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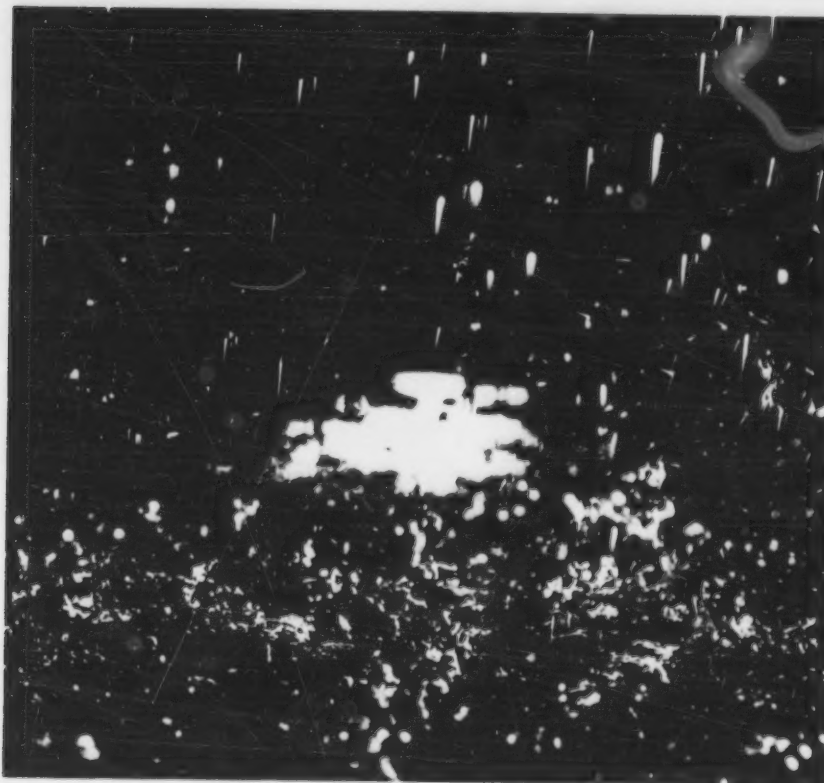
by fax at
1-800-245-9274 (outside Canada, 613-748-4069)

To reach us online, visit our home page at <www.cmhc-schl.gc.ca>

Your Municipality has purchased this *CMHC Household Guide to Water Efficiency* to help you find ways of reducing water use in and around your home. This should not be considered an endorsement by the CMHC of your Municipality, or as any representation by the CMHC regarding the quality and timeliness of your Municipality's water efficiency program.

Canada Mortgage and Housing Corporation supports the Government of Canada policy on access to information for people with disabilities. If you wish to obtain this publication in alternative formats, call 1-800-668-2642.

WATER EFFICIENT CANADA



Project Manager: Cate Soroczan, Researcher

CMHC offers a wide range of housing-related information.
For details, call 1-800-668-2642 or visit our home page at <www.cmhc-schl.gc.ca>

Cette publication est aussi disponible en français sous le titre: (Économiser l'eau chez soi LNH 2496)

The information contained in this publication represents current research results available to CMHC, and has been reviewed by a wide spectrum of experts in the housing industry. Readers are advised to evaluate the information, materials and techniques cautiously for themselves and to consult appropriate professional resources to determine whether information, materials and techniques are suitable in their case. The drawings and texts are intended as general practice guides only. Project and site-specific factors of climate, cost, aesthetics, and so on must be taken into consideration. Any photographs in this book are for illustration purposes only and may not necessarily represent currently accepted standards.

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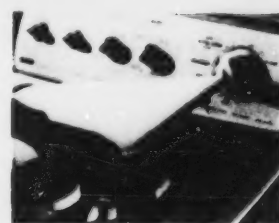
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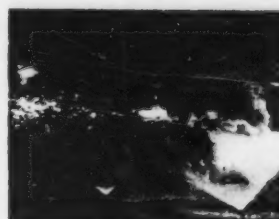
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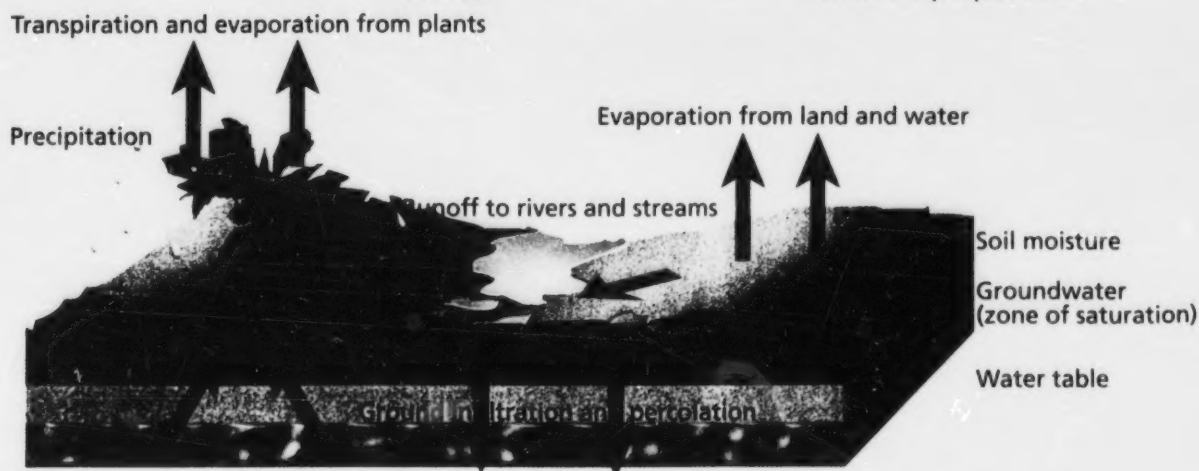


THE IMPORTANCE OF WATER

Water is a
basic necessity
of life, not just
for humans,
but for every
thing
on Earth.

Humans can live several weeks, even months without food; but only a few days without water. We must consume at least eight glasses of water each day. But drinking water or other liquids provides only half of the water we need; the other half comes from the food we eat. The water we drink and wash with and spray on our lawns and gardens has been here for billions of years, since the Earth was formed. There is a limited amount of water on the planet and it is reused continuously — it is not something we can make if we run out.

Although 75 per cent of the Earth's surface is covered with water, most of it is unavailable for our use. In fact, 97 per cent of the planet's water is too salty for humans and most animals and plants. About another 2 per cent of the water on Earth is held as glacial ice at the North and South poles. We are left with only about one per cent of all the water on this planet available to support life. Of the one per cent of available water, most is located deep underground in natural reservoirs called aquifers and must be pumped to the surface for people to use.



Two-thirds of the available fresh water (one per cent of all water on Earth) is located in underground aquifers and only one-third is located in surface waters, such as lakes and rivers.

THE IMPORTANCE OF WATER

Each and every system in our body uses water:

- Water makes up 83 per cent of our blood and 25 per cent of our bones;
- water transports body wastes;
- water lubricates body joints;
- water keeps our body temperature stable;
- water is part of the cells that make up the human body.

Residential water use, from flushing the toilet to watering the lawn, is the fastest growing sector of water usage across Canada. In fact, on a world-wide basis, Canadians are second

only to Americans in the amount of water individual residents use. The average Canadian uses about 120,000L (26,396 gal.) of water per year. At least half of this water use is unnecessary and wasteful. Water lost due to leaking faucets, old water-guzzling toilets, and excessive outdoor water use is enough to fill more than 9 billion bath-tubs each year!

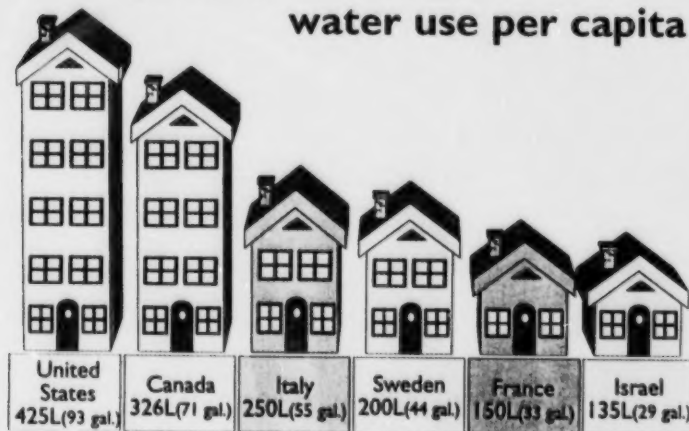
What does all this mean? It means that we must find a way to curb our use of water if we want to ensure an uninterrupted supply of fresh, drinkable water.



Litres / per Person / per Day

1. Territories- 268L (59 gal.)
2. B.C.- 440L (96 gal.)
3. Alberta- 257L (56 gal.)
4. Saskatchewan- 229L (50 gal.)
5. Manitoba- 250L (55 gal.)
6. Ontario- 271L (59 gal.)
7. Quebec- 386L (85 gal.)
8. New Brunswick- 415L (91 gal.)
9. Nova Scotia- 270L (59 gal.)
10. P.E.I.- 185L (40 gal.)
11. Newfoundland- 561L (123 gal.)

Average daily residential water use per capita



About **25%** of the
world's fresh
water is in the
lakes and rivers
of **Canada.**

Most of us look at the Great Lakes and all the other lakes, rivers and streams throughout Canada, and find it hard to imagine a shortage of water. But, "it's not the size of

the lake, it's the size of the pipe that carries the water" and the truth is, we are using too much water for the municipal water supply and treatment system to sustain. Added to this, is the fact that each and every time fresh water is used by residences, farmers, industrial facilities, institutions or others, it is degraded. There is a limit to the degree that municipal waste water treatment plants can clean the water that flows through their systems, and although the hydrologic cycle, the natural process by which water is re-circulated, cleans the water of most impurities, it takes time and has limitations.

NATURE'S WATER PURIFICATION SYSTEM

The fresh water that sustains all life on this planet is continuously recycled. Water is used, purified and reused in an endless cycle known as the water or hydrologic cycle. What we have, is all there is.

It is through the hydrologic cycle that water is cleansed and recycled. But the hydrologic cycle has a limited capacity to produce fresh water. If we continue to use water wastefully and pollute it, we compromise Mother Nature's cleansing and recycling process. The more we use water, the more sewage we produce, the more chemicals are used to purify water and treat sewage. This increases chemical loading to our lakes and rivers. Wise water use, including water conservation and pollution prevention, helps the water cycle continue to work.

The Hydrologic Cycle

Evaporation - The sun heats the water in oceans, rivers, puddles, and even laundry hanging on the clothesline. The droplets evaporate and float up into the air as water vapour.

Transpiration - Water vapour also rises into the air from leaves of plants and trees.

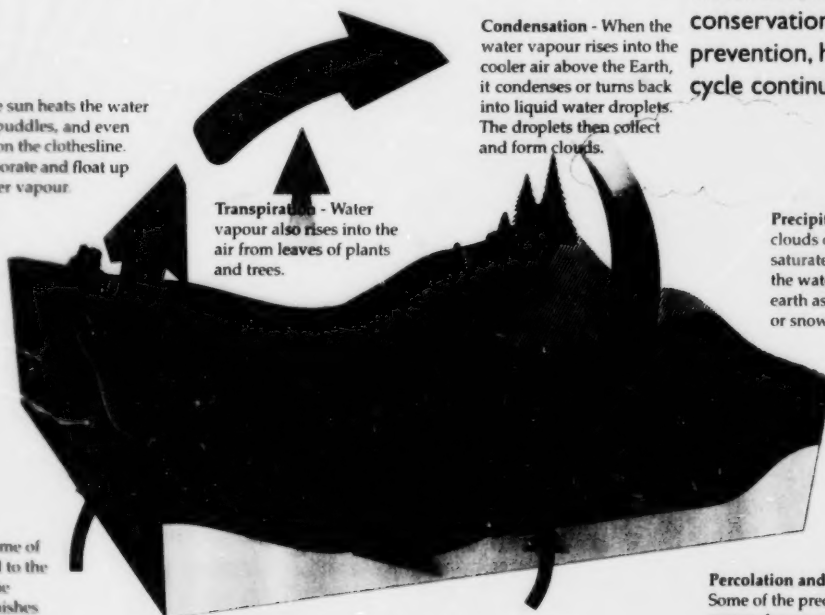
Condensation - When the water vapour rises into the cooler air above the Earth, it condenses or turns back into liquid water droplets. The droplets then collect and form clouds.

Precipitation - As the clouds cool and become saturated, they release the water back to the earth as rain, hail, sleet or snow.

Groundwater - Some of the water returned to the Earth soaks into the ground and replenishes underground reservoirs.

Storage - Some precipitation falls into lakes and streams, or is fed directly to these water bodies and water courses through storm drains.

Percolation and Runoff - Some of the precipitation moves downwards, percolating through pores and cracks in soil and rock. The excess becomes overland runoff into creeks, rivers and lakes.



THE IMPORTANCE OF WATER

SAFE, CLEAN WATER – EVERYONE'S CONCERN

All of us recognise the importance of water, but few of us are aware of the role all levels of government play in conserving and protecting this precious resource. Monitoring, research, education and training, development of policies and legislation, new technology design and development and upgrading and new construction of water supply and management systems, are some of the activities of federal, provincial and municipal governments in preserving the country's fresh water.

Canada's federal government shares many of the responsibilities for the country's water with the provinces. Included in the shared responsibilities are inter-provincial water issues and significant national and health related water issues, such as drinking water guidelines. Consequently, on the national level, several departments and agencies deal with various aspects of water issues. One very important aspect of water management that should be of interest to you as a resident, is water use efficiency. Some federal departments and agencies have programs and information available to assist you in reducing water use both in and around your home.

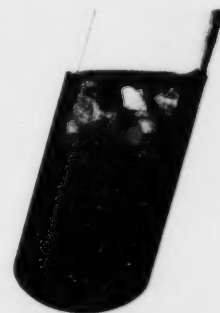
Canada Mortgage and Housing Corporation (CMHC), Canada's national housing agency, offers

information on water-saving equipment for your home and is working to bring water-conserving technology to homes across the country. On-site residential water reuse is one of the projects on which CMHC is currently working. Water reuse involves the collection of gray water from sinks, tubs and laundry washing to be reused for toilet flushing and irrigation. Although the practice of on-site water reuse is generally accepted in Japan, Australia and the United States, here in Canada this approach to water efficiency is relatively unknown. As governments across the country look to find more affordable means of reducing water use, on-site water reuse systems will no doubt become more commonplace here. To find out more about water reuse and water-saving methods and equipment for your home, visit CMHC's web site at www.cmhc-schl.gc.ca or refer to the publications listed in Appendix 4 of this guide.

Environment Canada is the key federal department with responsibility for water conservation and protection. One of the roles of this science-based department is to ensure the long-term sustainability of Canada's water resources. To this end, Environment Canada makes available water-saving information for householders through its web site at www.ec.gc.ca or through several publications that are listed in Appendix 4 of this guide.

Provincial governments have significant responsibility for water resource issues. The provinces own water resources, including both surface and groundwater, and have authority over the regulation and distribution of water. In addition, they regulate the way municipalities manage water supply, treatment and distribution.

Municipalities are the closest link to residents and supply many of the homes across Canada with potable water. Although the role municipalities play in treating and supplying fresh water, and in treating and managing waste water, varies from municipality to municipality, all have a major role to play in the protecting and conserving this valuable resource.



Many municipalities and regions have developed and implemented water efficiency programs for their residents. To find out if your city, municipality or region offers water saving programs and information, contact your municipality's water works department.

WATER USE IN CANADA

While Canada is considered to be a water rich nation – having 9 per cent of the world's available fresh water – most of us are using far too much to sustain over the long term.

In total, residents, industries and commercial establishments use over 12 billion L (2.6 billion gal.) of water per day. Most Canadians think that all the industries, schools, restaurants, hospitals, hotels, stores and offices use a lot more water than residents. The truth – households use over 60 per cent of all the water. Think of it, households in Canada use more than three times as much water as all the industries in this country combined, and far more than double the amount of water used by all the commercial facilities totalled together.

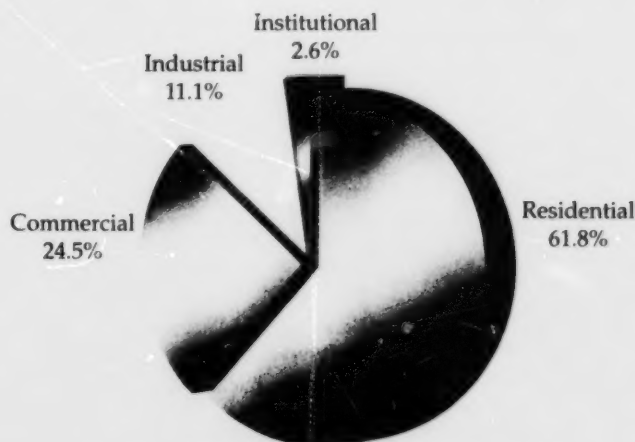
Although Canada is home to some of the world's largest freshwater lakes and a good supply of available groundwater, parts of the country sometimes suffer water shortages. Causes for these shortages include a lack of sufficient capacity of municipal water treatment and supply systems, isolation from large-scale municipal water treatment and supply facilities, surface and groundwater contamination, or drought.

A GROWING DEMAND FOR WATER

Even though personal water use has declined slightly over the last several years, a growing population and an aging municipal infrastructure create an ever increasing demand for improved and expanded water supply and waste water treatment. In fact, there is a combined shortfall totalling more than \$50-billion for municipal water infrastructure. About 24 million Canadians rely on municipally supplied water from one of the more than 4,000 water treatment and supply facilities located across the country. Consequently, to deal with the growing demand and aging infrastructure, most municipalities in Canada are facing huge capital costs for new water and waste water facilities or for upgrading and expanding existing ones.



Whether it's replacing a water-guzzling toilet, curbing excessive lawn watering, or repairing a leaking faucet, opportunities for reducing household water use abound! The more we reduce water use in and around the home, the more water we make available to meet the needs of a growing population, without overtaxing the water supply system.



Water Use By Sector

WASTE NOT, WATER NOT

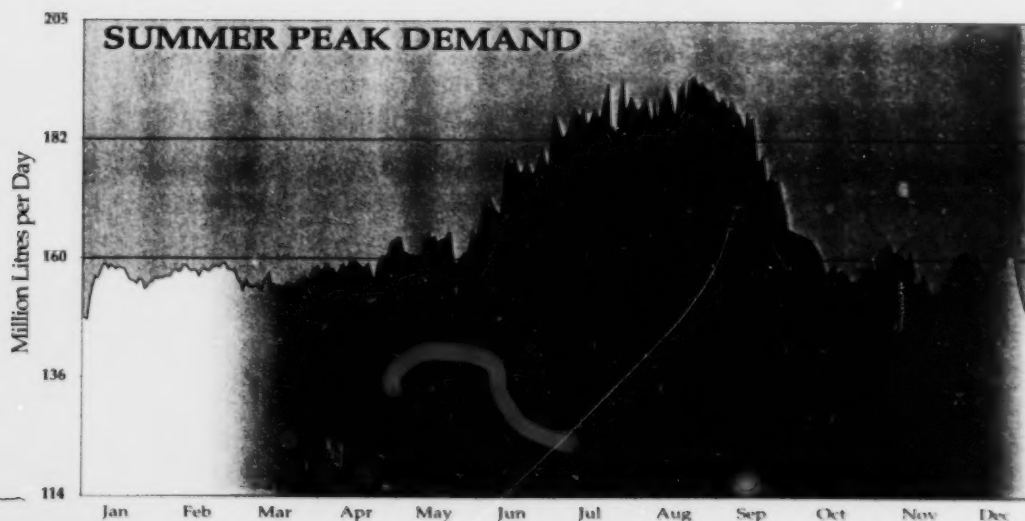
We waste a lot of water in this country – it is a recognised fact among experts that about half the water we use is wasted. This is never more true than in the warm weather months, when Canadians move outdoors. In fact, during the summer it is estimated that as much as 50 per cent of outdoor water use is unnecessary. By over-watering our lawns or washing debris from our driveways or walkways, we are literally throwing away one of our most precious resources. If we lived in California, we'd be paid a visit by the water police. That's right, wasting water in California is a chargeable

offence. We're lucky it hasn't come to policing water use here, but in many communities across Canada there is excessive water use during the summer months.

Many of us have heard the announcements about lawn watering restrictions during very dry periods in the summer. The reason for these announcements is the fact that the municipal water supply simply cannot keep pace with the heavy demand – there is a limit to how much and how fast water can be retrieved from a lake, river or aquifer, treated, and distributed to residents. If you rely on a well

for water, you are no doubt aware of the impact drought has on the available supply of water. Curbing water use in the summer will help to alleviate the demand placed on the system and reduce the impact of drought on water supply.

The problem of water use and water waste in the summer is such a concern to municipal water works departments that they have even given it a name: "Summer Peak Demand". In the summer, daily demand for water almost doubles. We use twice as much water in the summer to water lawns and gardens, fill and



WATER EFFICIENT CANADA

MANAGING WASTE WATER

clean swimming pools, and wash cars, than at any other time during the year. This peak demand places an enormous burden on our municipal water supply, creating water shortages and costing taxpayers a lot of money.

In fact, municipal water supply and treatment systems are designed to deal with peak demand -- in other words, they are built to meet summer water use. This means the facilities are built with 50 per cent more capacity than is needed for the rest of the year. If we reduced our use of water during the summer, the existing facilities would have additional water supply for new customers and any future facilities would be smaller and less-costly to build.

Although improvements have been made in the way waste water is managed in most parts of Canada, the level of waste water treatment varies greatly across the country.

TYPES OF WASTE WATER TREATMENT

Primary treatment

involves the mechanical removal of wastes

Secondary treatment

includes the use of biological processes, or bacteria, to breakdown the waste

Tertiary treatment

includes the use of chemical treatment processes which remove additional contaminants

In British Columbia, most waste water receives only primary treatment, while in Atlantic Canada, most of the waste water is discharged untreated into a receiving water body. Waste water receives mostly secondary and some tertiary treatment in the Prairie Provinces, tertiary treatment in Ontario and a mix of primary, secondary and some tertiary treatment in Quebec.

By reducing the amount of water we flush or wash down the pipe and by avoiding pouring hazardous household chemicals, such as paint thinners or cleaning products, down the drain, we reduce the burden on the waste water treatment facilities and the natural environment.



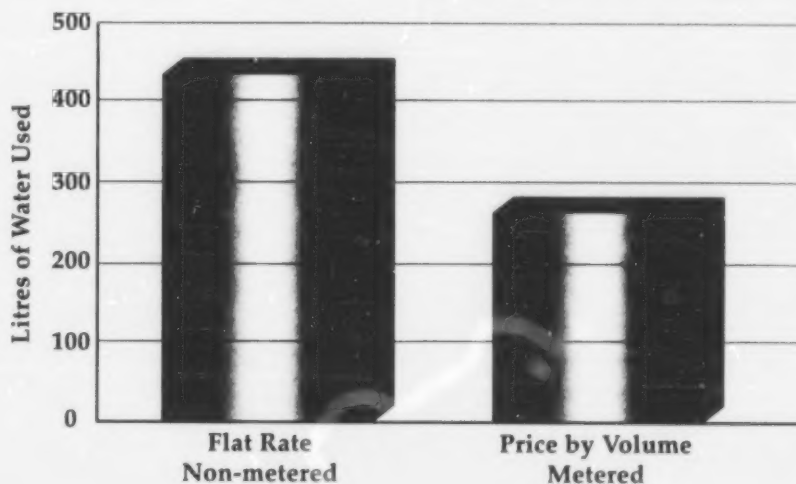
WATER USE IN CANADA

WATER EFFICIENCY AND THE BOTTOM LINE

Something industries have recognised for years — reducing water use saves money. Although you may be paying a flat rate for the water you use, the trend is toward metered water use. In other words, if you are not paying for the volume of water you use now, you will be soon. The reasons for metering water use are simple: providing a fair, user-pay system and reducing water use. Consider that in 1994, metered households used an average of 263L per (57.7 gal.) person per day, while non-metered households used about 430L (94.3 gal.) per person per day — that's 60,955L (13,363.2 gal.) more litres of water for each person every year.

In Canada, much of our water use is subsidized. You may be paying for only a portion of the total cost of supplying and treating the water you use and the waste water you send down the drain. But times are changing — the cost of providing treated water and managing waste water is growing and residents are being asked to pay their share. You may have already noticed that you are paying more for your water. Consider the following: residents in some

Comparison of Metered Versus Non-metered Water Use



European countries pay more than double what Canadians pay for their water and use only half as much. So whether you are metered or are paying a flat rate for water now, you will be paying more for it in the near future. The simple solution to growing costs and expanding demand — wise water use.

As you will see as you read through this guide, using water wisely is easy, saves money, reduces the demand placed on the municipal water supply and treatment system, and helps preserve and protect a most valuable resource.

WATER EFFICIENCY IN YOUR HOME

Reducing the amount of water your family uses doesn't have to be difficult — it is as easy as changing the way you use water and ensuring leaks are repaired. Saving water can also mean saving money — water efficiency has many rewards!

Keep the 4Rs of wise water use in mind every time you turn on the tap.

Reduce - Become conscious of the amount of water you're using and look for ways to use less.

Retrofit - Replace water-guzzling toilets and appliances with more water efficient models or retrofit existing appliances with water-saving devices.

Repair - Stop the leaks! In one year, a leak of one drip per second wastes 10,000L (2,167 gal.) of water - enough water to fill more than 60 bath-tubs. Most leaks are easy to fix by simply changing a worn washer.

Reuse - Consider water reuse technology. Some municipalities are considering the use of on-site and small community water reuse technology to save water and reduce the need for expanded water supply and treatment. The most likely water reuse technology

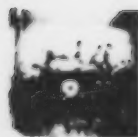
to be considered in the near future is the use of gray water from tubs, sinks, and washing for irrigation, and toilet and urinal flushing.

A good first step to water conservation in your home is to test for water leaks. Leaks can waste large amounts of water, often going undetected for long periods of time.



TESTING FOR LEAKS

1. If you have a water meter, periodically check for hidden water leaks by recording the water meter reading in the late evening and again in the early morning, or before and after any long period when there is no water use. Compare the readings to determine whether there was any water leakage over that period. If the meter indicates water use during the night, track down the source and have it repaired. Some water meters have a red triangular dial beside the numbers that record the volume of water used. This dial turns when water is running through the meter. If the dial is moving while there is no water being used in the house, there is a water leak somewhere.
2. Hidden leaks can be difficult to find. The dye test (see page 11) can be helpful in discovering toilet leaks. Sometimes you can hear a trickle of water when the taps are turned off. If you still can't determine the source, you may need to do some detective work to find the leak. One good place to start is in the laundry room. Some older-style laundry tub taps have a tube that connects to the floor drain. When the tap is turned on some water trickles into the floor drain (The water in the floor drain stops sewer gas odours from entering the house). When the tap is closed, the water should stop trickling. Worn washers can allow the water to continue to flow to the floor drain and be the source of a leak.



WATER EFFICIENCY IN YOUR HOME

WATER EFFICIENCY IN THE BATHROOM

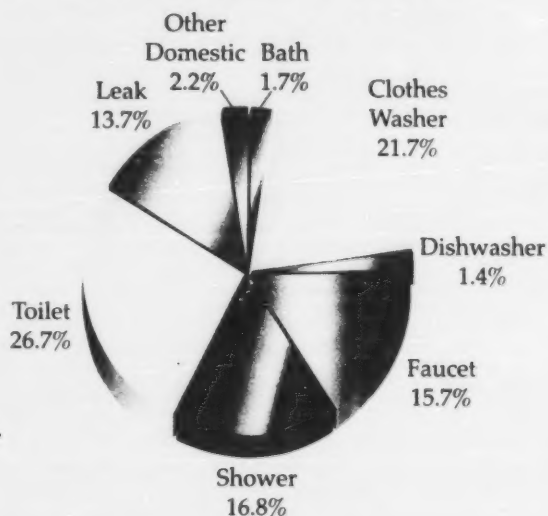
Half of all the water you use in your home goes down your bathroom drains. The biggest single water-guzzler is your toilet.

TOILETS

Up to 26.7 per cent of the water consumed in your home is flushed down the toilet. If you don't have a 6-litre toilet, every time you flush your toilet, between 13 and 26L (2.8 and 5.7 gal.) of water is sent to the sewage treatment plant - more than half of that water is flushed unnecessarily! Think of it this way — over the course of a year each one of us will flush about 30,000L (6,599 gal.) of water down the toilet to dispose of a comparatively meagre 650L (143 gal.) of body waste [assuming 4.5 flushes/person/day, and an 18L (3.9 gal.) toilet].



Breakdown of Indoor Water Use



AWWA Research Foundation
Residential End Use of Water Data



REPLACE YOUR TOILET

The most effective way to reduce the amount of water used for flushing toilets is to replace your existing high water use toilet with an Ultra Low-Flush (6-litre) toilet. These toilets are specially designed to function with only 6L (1.3 gal.) of water per flush instead of 13L (2.8 gal.) or more. A 6-litre toilet provides the same flush power with a lot less water. Although the tank holds 13L (2.8 gal.), it only releases 6L (1.3 gal.) with each flush. The remaining 7L (1.5 gal.) is used to "push-start" the 6L (1.3 gal.) of water flushed through the bowl. This increased pressure means less water is required to clear the bowl. Other improvements include a flow pattern in the bowl that directs more water through the trapway, reducing the swirling action of the water. The trapway develops a siphoning action that creates more flushing power without using more water. You get the performance you expect, with water savings per flush of over 50 per cent for a 13L (2.8 gal.) toilet and over 70 per cent for a 20L (4.3 gal.) toilet.

How much money you save by replacing a 13 or 20L (2.8 or 4.3 gal.) toilet with a 6-litre (1.3 gal.) toilet depends entirely on where you live in Canada and in turn, whether or not you pay for

the water you use. If you live in a municipality where your water use is metered, check your latest water bill to determine the rate you pay. This will allow you to calculate the dollar savings you can expect by replacing your toilet. For those living in municipalities where water use

leak could cost you hundreds of dollars. Leaks occur when the toilet is out of adjustment or when parts are worn, so it's important to check periodically for leaks. If you discover a leak you may be able to repair it by following the information provided in this guide.

The older the toilet the more water it uses per flush.

Toilet Age	Water use per flush
Prior to 1985	20+L (4.3 gal.)
1985 to 1995	13L (2.8 gal.)
1996	6L (1.3 gal.)*

*Check for water use per flush, as 13L (2.8 gal.) toilets are still available.

is not metered, remember, no matter where you live in this country, for an average family, replacing an older model toilet with a 6-litre model can mean water savings of more than 80,000L (17,597 gal.) per year!

TESTING FOR TOILET LEAKS

Toilets are notorious for their hidden leaks. They can waste hundreds of litres of water a day, undetected. In fact, a toilet that continues to run after flushing can waste 20 to 40L (4.3 to 8.7 gal.) per hour — that's 200,000 to 400,000L (43,994 to 87,987 gal.) of water in one year — enough water to fill a large in-ground swimming pool. If you're charged for the water you use, over time, an undetected

TO TEST YOUR TOILET FOR

LEAKS, PUT SOME FOOD

COLOURING IN THE HOLDING

TANK AND WAIT ABOUT

15-30 MINUTES. IF, WITHOUT

FLUSHING, THE COLOUR

SHOWS UP IN THE BOWL,

YOU'VE GOT A LEAK THAT

COULD BE COSTING YOU

HUNDREDS OF DOLLARS

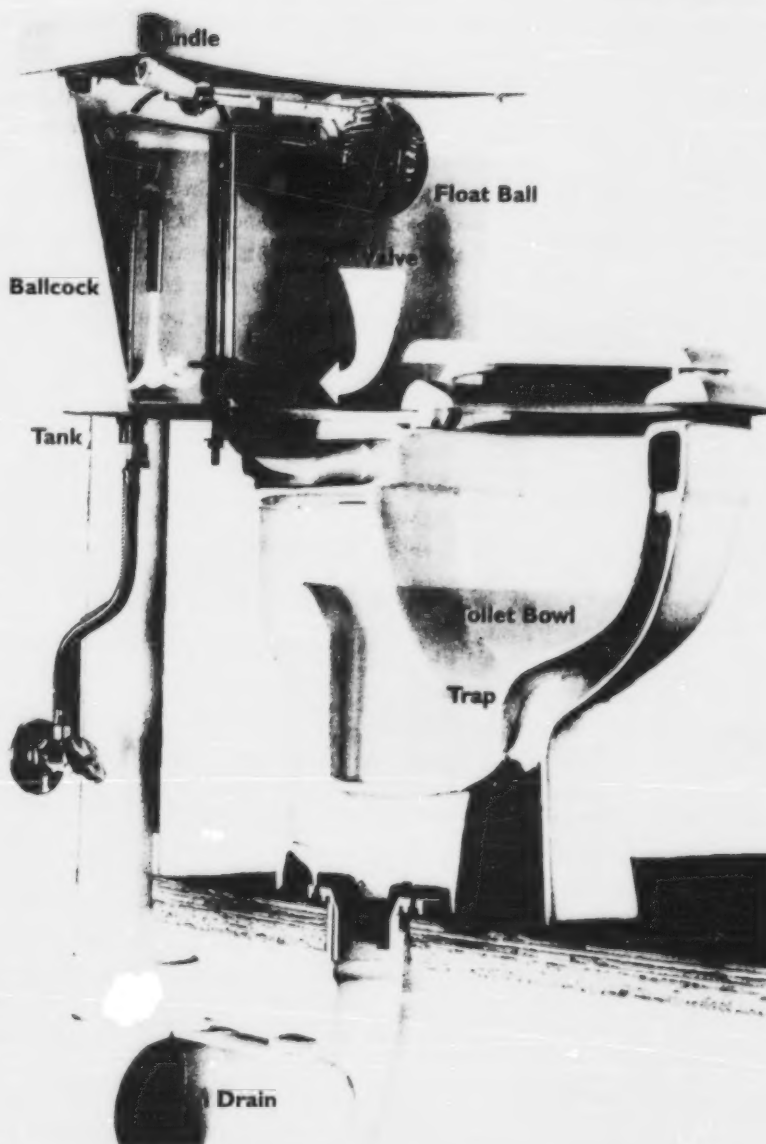
EACH YEAR.



REPAIR LEAKING TOILETS

Generally speaking, a standard two-piece toilet with an upper tank bolted to a base can be repaired easily. There are some situations, depending on the style of the toilet and the type of repair required, when it is wise to call in a licensed plumber to avoid any costly complications. Before trying to repair a toilet, you should understand how the system works.

1. Depressing the handle causes the flush ball (or a flapper in some toilets) to lift off the flush valve, allowing the release of water from the tank into the toilet bowl.
2. The flush ball seats itself back onto the flush valve, shutting off the flow of water to the bowl.
3. The float ball lowers with the decreasing water level. This action lifts the inlet valve in the ballcock assembly unit that controls the flow of water into the tank.
4. Fresh water flows through the ballcock assembly into the tank. This causes the float ball to rise with the level of water. As the float ball rises, it depresses the inlet valve, shutting off the water flow when the tank is full.



Note: There are many different names for the same part in toilets. Some names change with the age and style of toilet. Every attempt has been made to use the most common names for the different parts.

Once it has been determined that there is a water leak in your toilet, you must now determine the cause of the leak. The most common reasons for toilet leaks are:

- A. The float ball needs adjusting or replacing.**
- B. The ballcock assembly (or inlet valve) is faulty and continues to allow water to enter the tank.**
- C. The flush valve needs adjusting or cleaning, or the flush ball (or flapper) needs replacing.**

To determine the most likely reason for your toilet leaking, remove the top of the tank and check the water level in the tank.

LEAKING TOILET PROBLEM

- A. If the water is high and continually running into the top of the overflow tube, the float ball needs adjusting or replacing.**

Tools and materials required:

Screwdriver, new float ball if required, petroleum jelly.

Basic Repair Techniques

1. Lift the float ball and gently bend the attached float arm down slightly to keep the tank's water level between 12.5 and 25 mm (1/2 and 1 in.) below the top of the overflow pipe. The float arm can also be adjusted by turning the float adjusting screw found at the ballcock end of the float arm. Plastic rods cannot be adjusted by bending.
2. If adjusting the float arm does not stop the water from flowing, check the condition of the float ball. Replace the float ball if there is water inside it.
3. To remove a cracked float ball from the float arm, grasp the float arm with locking pliers and twist the float ball counter-clockwise. Replace the ball, coating the threads of the float arm with petroleum jelly before reattaching.
4. If water still runs after doing steps 1, 2 and 3 above, you will probably need to repair or replace the ballcock assembly, as noted below.

- B. If the problem is neither the flush ball nor the float ball, the ballcock assembly (inlet or refill valve) needs to be repaired, or better still, replaced.**

Tools and materials required:

Screw driver and, if needed, new ballcock assembly and washers.

Basic Repair Techniques

1. Turn off "shut-off" valve and flush toilet to remove all water in the tank.



WATER EFFICIENCY IN YOUR HOME

2. It is very difficult to repair a ballcock assembly, though some can be repaired with the aid of a plumbing guidebook or a licensed plumber.
3. To replace a faulty ballcock assembly, remove it and take to the store for an exact match. Most units can be removed by unscrewing the two screws in the linkage arm.
4. Check the condition of the washers as well, and buy exact replacements if necessary.
5. Install the new ballcock assembly by reattaching the two screws.
6. Turn on the shut-off valve and test your repair by flushing. The water level should be 12.5 to 25 mm (1/2 to 1 in.) below the top of the overflow tube.
7. If the water level is not right, try the dye test again, consult a plumbing guidebook and/or call a licensed plumber.

C. If the water level in the tank is more than 25 mm (1 in.) below the top of the overflow tube, the flush valve or flush ball (flapper) needs adjusting, cleaning or replacement.

Tools and materials required:

Needle nose pliers, new flush ball/flapper (if needed), emery cloth or steel wool or a non-abrasive scouring pad.

Basic Repair Techniques

1. Before working on the flush valve or ball/flapper, turn off the water to the toilet or at the main shut-off valve.
2. Flush the toilet to empty the tank.
3. Observe the ball/flapper as you flush the toilet. If it fails to drop directly onto the flush valve, try realigning it by adjusting the lift wires or lift chain.
4. Adjust lift wires so that wires are straight and operate smoothly when handle is pushed. Adjust lift chain so it hangs straight from handle lever with about 12.5 mm (1/2 in.) slack. Excess chain can be shortened by hooking the chain in a different hole or by removing links with needle nose pliers.



5. Check flush ball/flapper for signs of damage or wear. A worn ball/flapper will allow water to leak into the bowl between flushes. If there are signs of wear, the flush ball/flapper should be replaced. (TIP: rub finger on the flush valve seat before cleaning it, if finger is black, replace the flush ball/flapper. The black markings indicate a deterioration of the ball/flapper rubber.) Unhook the lift chain/wire and remove the ball/flapper and take it to the store for an exact match. Re-attach the ball/flapper to the lift chain/wires.
6. If the flush ball/flapper is okay, check the condition of the flush valve where the ball/flapper rests. Mineral deposits and sediment on the flush valve seat can prevent the ball/flapper from sealing tightly and permit water to run continuously into the bowl.
7. If the flush valve seat needs cleaning, gently scour inside the seat and its rim. Clean brass with an emery cloth or steel wool, and clean plastic with a non-abrasive scouring pad.
8. Replace the flush valve if cleaning and adjusting are unsuccessful or if the surface is pitted or damaged. This is a more complicated repair that may require the aid of a home plumbing repair guide or a licensed plumber.

WATER-SAVING DEVICES FOR TOILETS

If replacing an older model, high-flow toilet is not an option, consider retrofitting your existing toilet or toilets with flow reducing mechanisms. These devices reduce the flow of water in the toilet through displacement or retention, or by altering the flushing mechanism. Although these devices can save a lot of water over the life of the toilet, it is important to select the right one. Be sure to check with your toilet's manufacturer before purchasing or installing one of these devices. Your municipality's water works department may have valuable information on the different flow reducing devices available and their efficiency, so be sure to inquire before making a purchase.

SHOWERS AND BATHS

A common misconception is that bathing uses more water than showering. Although a shower can use less water if short in length, many of us spend 10 minutes or more in the shower. To get a handle on how much water you use, plug the drain the next time you shower and compare it with taking a bath. Spending less time in the shower or cutting down on the water you use to fill the tub for a bath, can add up to significant water savings over time. It will also translate to savings on your gas or electric bill, since there will be less of a demand on your hot water heater.

Another way to reduce water use is by installing a "low-flow shower head". Low-flow shower heads mix a greater amount of air with the water, reducing water consumption by as much as 65 per cent. Although there is less water and more air than a standard shower head, they are specially designed to provide a forceful spray. Not only do you save water, you also save on heating the water, so your hot water goes further. Low-flow shower heads have improved a lot in recent years — seek recommendations on styles and brand names from friends, family, plumbers or plumbing stores.

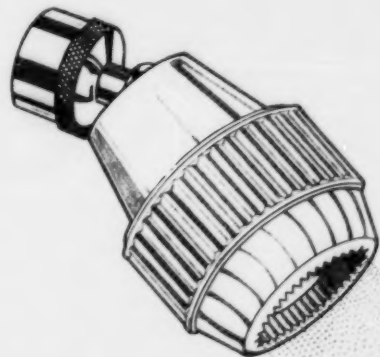


WATER EFFICIENCY IN YOUR HOME

SHOWER HEAD TYPE	WATER USE
Standard	18 - 27L (4 - 6 gal.) per minute
Low-flow	9 - 11L (2 - 2.4 gal.) per minute

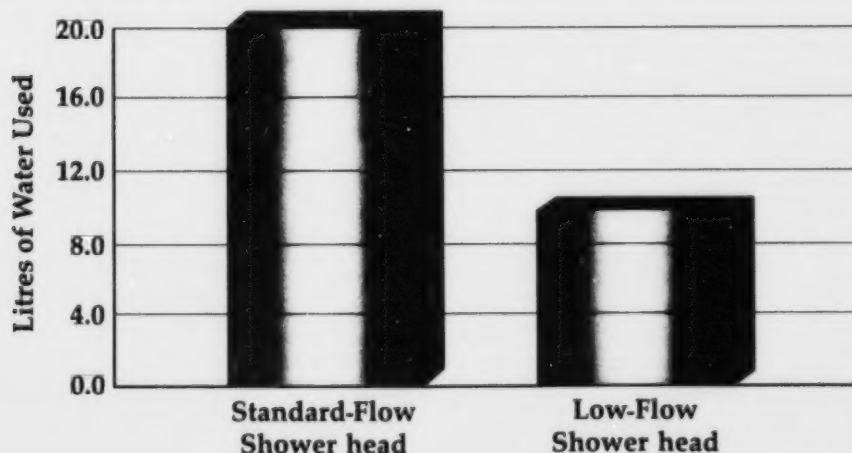
To determine whether you should install a low-flow shower head, check the flow-rate of the existing unit by following the steps below:

1. Check first for a stamped flow-rate on the neck of the shower head. Most low-flow models state their flow-rate, if none is found, it probably is not low-flow.
2. Turn your cold water tap to the FULL-FLOW position, (TIP: use the shower head "diverter" when ready to start measuring and to turn off tap quickly);
3. Hold a graduated container [e.g., 2.25L (0.5 gal.) juice jug] under the shower head or faucet for a total of six seconds;
4. Measure the amount of water collected and multiply this amount by ten to get the volume per minute. For example, if you collected 1.9L (0.4 gal.) in six seconds then the flow-rate is $1.9 \times 10 = 19\text{L}$ (4 gal.) per minute.



A new low-flow shower head can pay for itself very quickly. Additional savings can be achieved through the use of a model with a "trickle" button that allows you to stop all but a trickle of water while you lather up or shampoo, and then resume at the same flow-rate and temperature.

Comparison of Standard-Flow and Low-Flow Shower heads

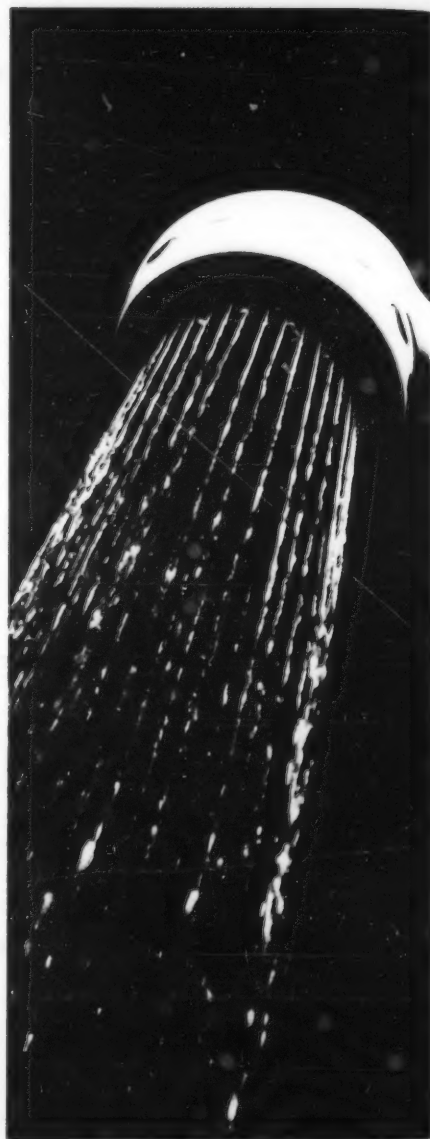


INSTALLING A LOW-FLOW SHOWER HEAD

Tools and materials needed:

- channel-lock pliers or pipe wrench
- rag or tape or piece of rubber
- bath-tub size piece of carpeting or rubber mat
- rag or wire brush
- crescent wrench
- thread seal tape
- spray lubricant
- low-flow shower head

1. Before attempting to remove the old shower head, check the condition of the shower arm and piping. Call for professional help if:
 - your home has galvanized iron pipe, identifiable by its silver colouring and threaded fittings (galvanized pipe corrodes with age and is very difficult to work with);
 - the existing shower head does not remove easily after using spray lubricant;
 - the shower head extension pipe moves, twists or leaks.
2. Cover the bathtub with a rubber mat or carpeting to protect the enamel.
3. Affix channel-lock pliers or a pipe wrench securely to the shower arm, approximately 2.5 cm (1 in.) above the shower head attachment nut. (TIP: to prevent scratching, try wrapping a rag, layers of masking tape, or a piece of rubber tubing, such as an old bicycle inner-tube, around the shower head pipe when removing or installing the shower head.)
4. Affix a crescent wrench to the shower head attachment nut. Maintain a firm hold on the channel-lock pliers and turn the crescent wrench slowly in a counter-clockwise direction to remove the shower head.
5. If the shower head is stuck, it may be necessary to apply a small amount of spray lubricant to soften the scale and hard water deposits.



WATER EFFICIENCY IN YOUR HOME

6. Turn the shower on briefly after the removal of the fixture to flush out any old residue, and clean the pipe threads of the old sealant with a rag or wire brush.
7. If the pipe ends in a ball-shaped fitting, it too will have to be replaced or a ball-fitting adapter installed.
8. Test fit the new shower head (screw on by hand) to ensure the threads match and then remove.
9. Wrap thread seal tape, 1.5 turns clockwise around the threaded tip of the shower arm.
10. Install the new shower head.
11. Wrap a cloth around the shower head attachment nut and tighten slightly with a crescent wrench.
12. Turn on the water to check for leaks. If necessary, tighten further or reapply thread seal tape to stop the leaking.

HOW MUCH CAN I SAVE WITH A NEW LOW-FLOW SHOWER HEAD?

The actual dollar savings you will reap by installing a low-flow shower head depends on where you live in Canada and in turn, whether you pay for the amount of water you use. Consider that during a 6 minute shower you could save as much as 108L (23 gal.) of water with a low-flow shower head. If you shower every day this could translate to a savings of about 40,000L (8,798 gal.) of water a year. Multiply this amount by the number of members in your household, and you'll see the savings really add up. Remember, reducing water use for showering also reduces the energy needed to heat the water.

WAYS TO REDUCE WATER USE IN THE BATHROOM

- install faucet aerators (see section on "Faucet Aerators", page 20);
- avoid running water when brushing teeth, shaving, washing up and cleaning - fill a cup or the sink with some water when doing these tasks and you could reduce water use for these tasks by 60 to 80 per cent;
- never use the toilet as a garbage can;
- try taking short showers instead of a bath;
- install a low-flow shower head (see section on "Showering and Bathing", page 17)



WATER EFFICIENCY IN THE KITCHEN

The water you use in your kitchen represents as much as 15 per cent of your total indoor water use. Most of the water waste in the kitchen results from allowing the kitchen tap to run freely while we wash dishes, fruit and vegetables and clean surfaces. Following the simple water-saving tips described below can add up to big water-savings.

WATER-SAVING TIPS FOR THE KITCHEN

1. Fully load your dishwasher and you may well use less water than by washing dishes by hand. If you do wash dishes by hand, partially fill one sink for washing and the other for rinsing. If you only have one sink, place washed dishes in a dish rack and rinse them all at once with a spray of water.
2. Use leftover dish-water to make a terrific organic bug spray for aphids, white flies and spider mites. Simply strain the water (to remove bits of food) and pour into a spray bottle. Spray on indoor and outdoor plants.
3. Wash fruit and vegetables in a partially filled sink or in a container of water, instead of allowing water to run constantly. A quick final rinse should be all that is necessary. Save the rinse water for watering your plants.
4. Capture excess water in a container when running the tap is necessary. This can provide an ample supply of water for indoor and outdoor plant watering.
5. Steam vegetables on the stove or in the microwave to reduce the amount of cooking water required.
6. Keep drinking water in the refrigerator in a covered container, instead of running the tap while waiting for water to get cold. Every few days, be sure to wash the container and change the water. Use leftover drinking water on plants or for cleaning.
7. Partially fill the sink or a container when cleaning the kitchen or rinsing cloths.



FAUCET AERATORS

Standard faucet aerators can use up to 16L (3.5 gal.) of water per minute. Low-flow aerators can cut water use by half or more. Low-flow aerators are inexpensive, widely available at all hardware and plumbing supply stores and easy to install. Before purchasing, check that your faucet has screw threading on either the outside or inside of its mouth. If there is no threading, then you will also need a device called a "universal faucet adapter".

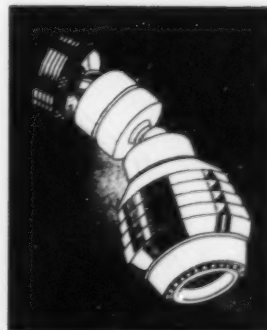


INSTALLING A LOW-FLOW FAUCET AERATOR OR SWIVEL SPRAY TAP

Tools and materials required:

- low-flow aerator
- universal faucet adapter (if required)

1. Unscrew the existing faucet aerator (it will have either inside or outside threading).
2. Hand screw the aerator/spray tap, ensuring that the threads match before tightening.



Note: Low-flow aerators are adaptable to both inside or outside threading, though you may have to remove the washer that's included in the aerator, depending on the style of your faucet. It may be necessary in some cases, to wrap the faucet threading with thread seal tape to stop leaks.

Do not install a low-flow faucet aerator if:

1. The existing aerator will not remove easily by hand
2. Threads are damaged
3. The new aerator affects the hook-up of a portable dishwasher or water filter tap hook-up



WATER EFFICIENT CANADA

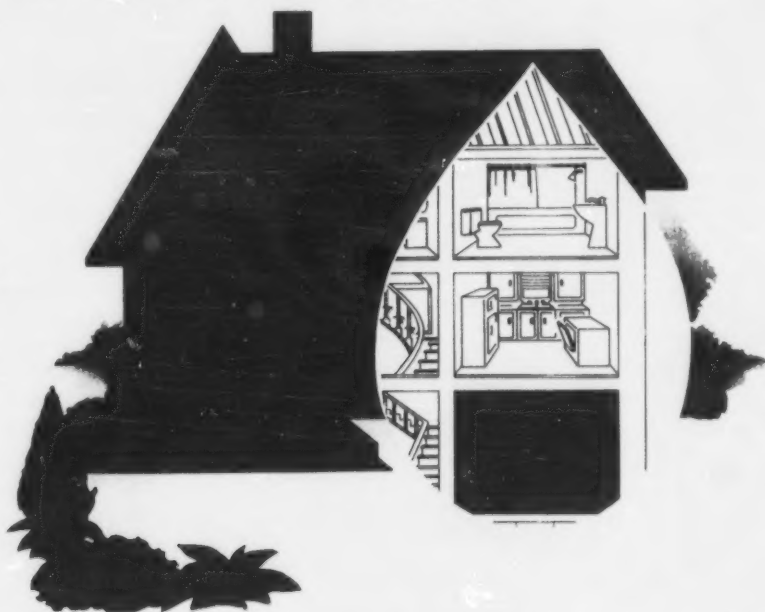
WATER TREATMENT SYSTEMS

Some home water filtration systems can also be water wasters. Though these systems are designed to take more impurities out of the water and may make it safer and tastier to drink, some systems waste a lot of water. For example, reverse osmosis systems return only 10 to 20 per cent of the water that flows through them. The rest goes down the drain.

SINK GARBAGE DISPOSAL SYSTEMS

Sink garbage disposals waste water. These systems grind up vegetable matter and, with the aid of lots of running water, send the slurry down the drain. Not only can these systems consume hundreds of litres of water each week, they also increase the load for the water treatment plants. To save money on your water bill and to create a great soil conditioner for your gardens, consider instead, composting kitchen wastes.

WATER EFFICIENCY IN THE LAUNDRY ROOM



Clothes washing, at 20 per cent of your total water use, accounts for the third highest use of water inside your home.

WATER-SAVING TIPS FOR WASHING CLOTHES

1. Wash only full loads of laundry, but avoid overloading the machine.
2. If your machine has a "suds-saver" feature, be sure to use it (this feature reuses the clean rinse water for washing the next load).
3. If you don't have a suds-saver feature but want to reuse the rinse water, consider trying to collect the rinse water and using it to water your garden.
4. If your machine has an adjustable water-level indicator, set the dial to use only as much water as is really necessary.
5. Always choose cold water for the rinse cycle and only use hot or warm water for very dirty loads or whites.



WATER EFFICIENCY IN YOUR HOME

WASHING MACHINES

When buying a new washing machine, water-efficiency features, such as water level controls, are standard fare on most models. You may also want to consider buying a machine with a suds-saver option. To maximize your water-savings, you may want to purchase one of the new water efficient washing machines which use as much as 45 per cent less water per load and are purported to be gentler on your clothes. Although these new machines are more expensive to purchase, the water and energy savings they offer will recoup the cost difference in a few years.



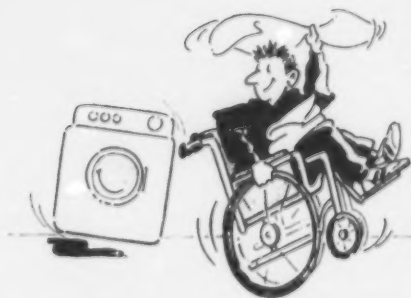
WATCHING WHAT GOES DOWN THE DRAIN

How many times have you cleaned a paintbrush with turpentine in the laundry tub and washed the solution down the drain? It is an action of which many of us are guilty. The careless disposal of solvents, paints, chemical household cleaners, motor oils and even cooking fat, can harm your piping system, be very difficult to deal with at the sewage treatment facilities and, most importantly, prove harmful to the aquatic environment.

Why are these chemicals so dangerous? Many of them kill the bacteria which break down the organic matter in sewage. Without these bacteria, the treatment process is severely impaired. As well, many of the chemicals we dump down our

drains are resistant to any treatment and remain in the water when it is returned to the lake. Despite the cleansing effect of the natural water cycle discussed in Chapter 1, and the municipal water treatment process, many of these chemicals remain in the water. By simply switching to more environmentally friendly cleaning products such as baking soda, vinegar, borax and lemon juice, you can reduce the chemical burden to our waterways. Other chemical contaminants such as turpentine, motor oil and paint must be delivered to a household hazardous waste depot for proper disposal.

Contact your municipal works department for information about household hazardous waste and disposal options.



REPAIRING LEAKING TAPS

A couple of times a year it is a good idea to take a walk around your home and check all faucets for leaks. Leaks occur when washers, o-rings, or seals inside the faucet are dirty or worn. Repairing leaking taps can be simple to do, though there are some variations in tap designs that may provide a challenge. Before beginning work, you must first identify your faucet design and try to determine what replacement parts may be needed.

Remember, the first step in doing any plumbing repair is to turn off the water before beginning work. To turn off the water, either close the shut-off valve underneath the faucet you are about to work on, or close the main service valve found near the water meter. If you turn off the shut-off valve, open the faucet you are about to work on until the water stops. If you turn off the main service valve, turn on the lowest tap in the house (for example, the laundry tub) to clear water from all the lines before beginning work.

Note: These instructions are neither comprehensive, nor intended to include all situations you may encounter in your home. For safety, you should use caution, care and good judgement when following the procedures described in this guide. If in doubt, visit a plumbing supply store, consult a home plumbing guide, or call a licensed plumber. Easy and inexpensive plumbing jobs can quickly become an expensive nightmare if you have old plumbing or fixtures, improper tools and materials, or insufficient knowledge and skill.

SOME GENERAL TIPS WHEN REPAIRING LEAKING FAUCETS:

1. If faucets are difficult to remove, you may need to apply a little penetrating oil, wait a few minutes and then try again.
2. To ensure a correct selection, take the worn parts with you to the store for comparison.
3. To avoid scratching the shiny surfaces of the faucets, cover the gripping parts of tools with masking tape or a cloth.
4. When working on basement taps, be sure that the hot water tap shuts off completely to avoid siphoning the hot water tank.

The charts that follow describe the four main types of faucets and the basic repair techniques to stop leaks.



BASIC TYPES OF FAUCETS AND COMMON PROBLEMS

COMPRESSION FAUCET

Description:

- A compression style faucet has washers or seals that must be regularly replaced;
- two handles for separate control of hot and cold water;
- a threaded stem assembly inside the faucet body;
- when shutting off faucet, can usually feel the rubber washer being squeezed inside the faucet.

Tools and Materials Required:

- Screwdriver, channel-lock pliers, utility knife;
- universal washer kit (includes a variety of sizes of washers and o-rings) and faucet grease.

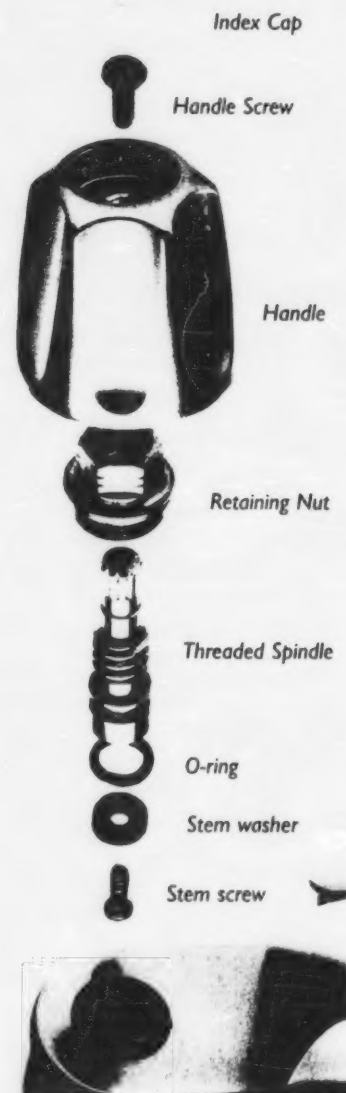
Techniques for Repairing Leaks

To stop dripping from the spout, replace worn washers:

1. Remove cap from top of faucet handle and remove handle screw.
2. Remove handle by pulling straight up. If handle is corroded and difficult to remove use a handle puller. (TIP: handle pullers are available from rental centres or can be purchased for about \$20)
3. Unscrew stem assembly from the faucet with channel-lock pliers or wrench. (Replace faucet if stem assembly is badly worn.)
4. Remove brass stem screw from the stem assembly to release the stem washer.
5. Rub your finger on the seat under the washer to ensure there is no pitting or notches that can allow water to leak.
6. If the surface is not smooth, you will need a faucet seat wrench to remove the seat, refer to a plumbing guide or call a plumber to assist with this job.
7. Install new washer and reassemble the faucet.

To stop leaks around the handle, replace worn o-ring:

1. Follow steps 1-4 above to remove the stem assembly from the faucet body.
2. Disassemble the stem by unscrewing the threaded spindle retaining nut to expose the o-ring.
3. Cut off the o-ring and replace with an exact duplicate.
4. Coat the threaded spindle with faucet grease, then reassemble the faucet.



BALL-TYPE FAUCET

Description:

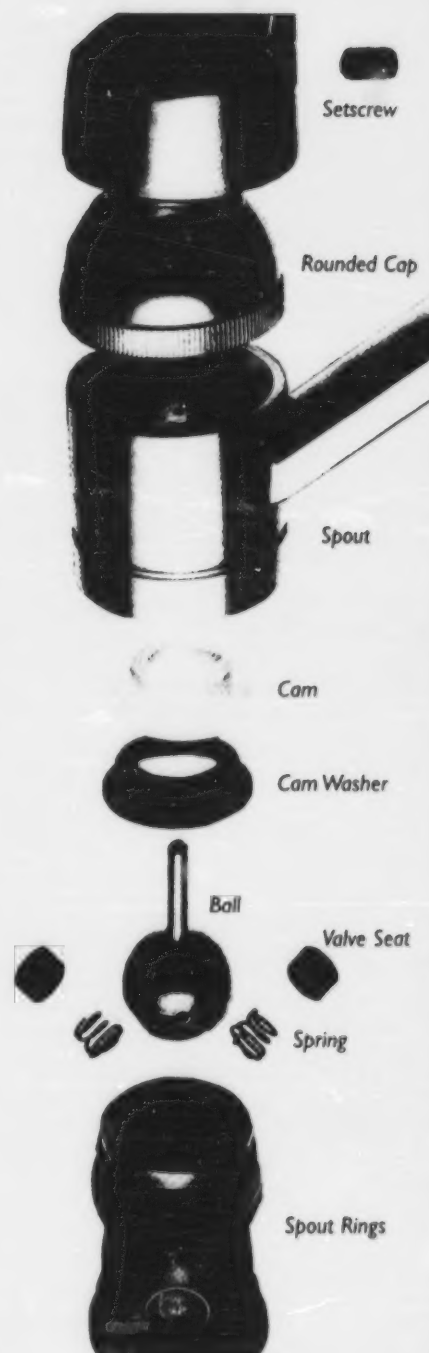
- Ball-type faucets are known as "washerless" faucets and require little maintenance;
- single handle, over a dome-shaped cap;
- a hollow metal or plastic ball inside the faucet body controls the temperature and flow of water;
- most have a round cap with knurled edges located under the handle.

Tools and Materials Required:

- Channel-lock pliers, Allen key wrench, screwdriver, utility knife;
- ball-type faucet repair kit, new rotating ball (if required), o-rings, faucet grease, masking tape.

To stop dripping from the spout, replace worn valve seats, springs and/or damaged ball:

1. First try tightening the cap with channel-lock pliers gripping the area with the knurled edges. (TIP: to prevent scratches to the shiny chromed finish, wrap masking tape around the jaws of the pliers) If tightening does not work, then disassemble and install replacement parts, following the steps below.
2. Loosen handle setscrew with an Allen key wrench and remove handle to expose faucet cap.
3. Remove the rounded cap with the channel-lock pliers by gripping the knurled edges of the cap and turning counter-clockwise. (TIP: keep the masking tape on the jaws of the pliers to avoid scratching)



WATER EFFICIENCY IN YOUR HOME

4. Lift out the faucet cam, cam washer, and the rotating ball. Inspect the ball for signs of wear, replace if necessary. (TIP: though metal replacement balls are more expensive than plastic, they are more durable)
5. Using a screwdriver, pry out the old springs and valve seats from inside the faucet and replace with new ones.
6. Reassemble faucet and replace the cam washer and cam, if required.

To stop leak from base of faucet, replace worn o-rings:

1. Follow steps 1-5 above and continue to disassemble the faucet by removing the spout to expose the o-rings. Remove spout by twisting it upward.
2. Cut off the old o-rings, coat new ones with faucet grease and then install.
3. Reassemble faucet.



CARTRIDGE FAUCET

Description:

- Cartridge faucets are known as "washerless" faucets and require little maintenance;
- identified by the narrow metal or plastic cartridge inside the faucet body;
- the hollow cartridge insert, lifts and rotates to control the flow and temperature of water.

Tools and Materials Required:

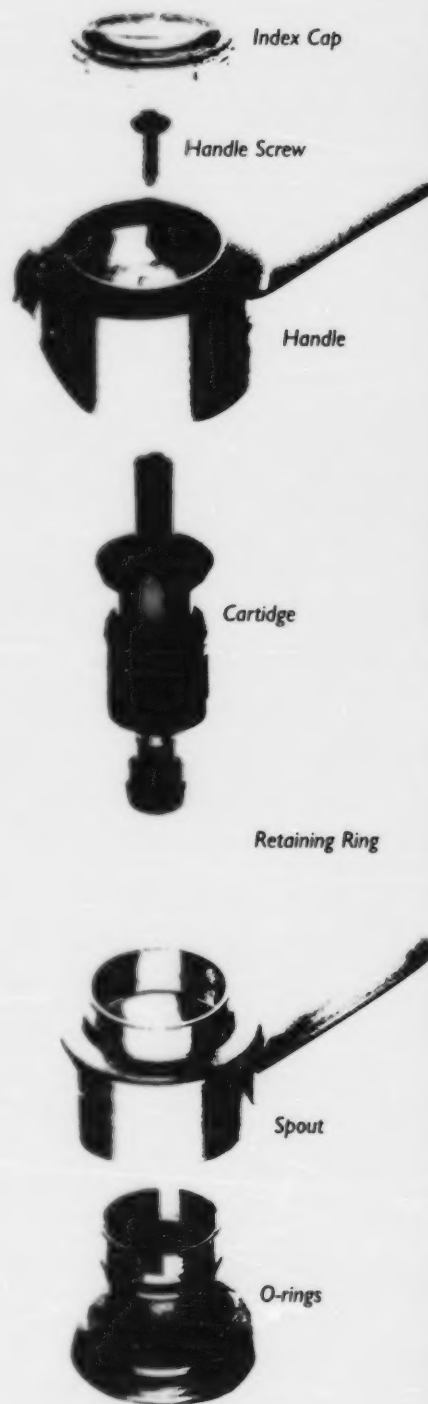
- Screwdriver, channel-lock pliers, utility knife;
- replacement cartridge, o-rings, faucet grease.

To stop dripping from the spout, replace worn cartridge:

1. Pry off the index cap on top of faucet.
2. Remove the handle screw underneath the cap.
3. Remove faucet handle by lifting it up and tilting it backwards.
4. Remove the threaded retaining ring with channel-lock pliers. (Remove retaining clip, if present, that holds the cartridge in place)
5. Attach channel-lock pliers to top of cartridge and pull straight up to remove cartridge.
6. Install new cartridge.
7. Reassemble faucet.

To stop leak from base of faucet, replace worn o-rings:

1. Follow steps 1-6 above and continue to disassemble the faucet by removing the spout to expose the o-rings.
2. Cut off worn o-rings with a utility knife.
3. Coat new o-rings with faucet grease and install.
4. Reassemble faucet.



DISC FAUCET

Description:

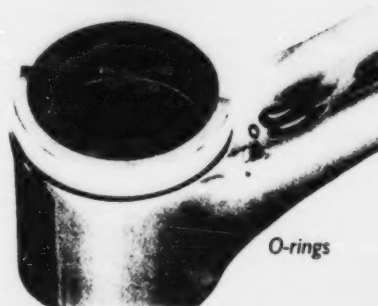
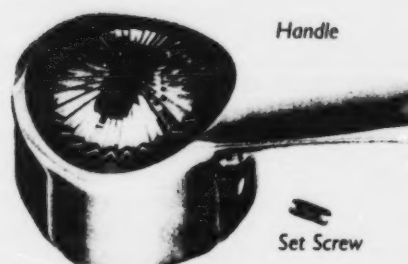
- Disc faucets are known as "washerless" faucets and require little maintenance;
- has a single handle and a wide, sealed cylinder inside the faucet body;
- cylinder contains two closely fitting ceramic discs that are slid into alignment by the faucet handle to allow water flow;
- installation of a new cylinder required only if leaking continues after cleaning.

Tools and Materials Required:

- Screwdriver;
- plastic/nylon pot scrubber, replacement cylinder (if needed).

To stop dripping from the spout, clean or replace cylinder:

1. Most leaks can be stopped by cleaning the neoprene seals and cylinder openings; install a new cylinder only if faucet continues to leak after cleaning.
2. To remove setscrew, rotate the faucet spout to the side and raise the handle, lift off the handle.
3. Lift off the escutcheon cap.
4. Remove the screws that hold the cylinder in place.
5. Lift out the cylinder and remove the neoprene seals from the cylinder openings.
6. Clean the cylinder openings and the neoprene seals with a plastic/nylon pot scrubber, then rinse with clear water.
7. Reassemble faucet.
8. Move handle to "ON" position, then slowly open shut-off valves. When water runs steadily, close faucet. (This action avoids the possibility of cracking the ceramic discs with the sudden release of air from the faucet).
9. If the faucet continues to leak from the spout, repeat steps 1-6, and install new cylinder.



PREVENTING FROZEN WATER PIPES

In some of the colder regions of Canada, many households struggle each winter to keep pipes from freezing. Often the solution employed is to leave a tap running. In some homes, a "bleeder" line is installed which allows the water to flow continuously through a small opening at the end of a supply line and into the waste water system. Both of these methods for preventing pipes from freezing waste an enormous amount of water.

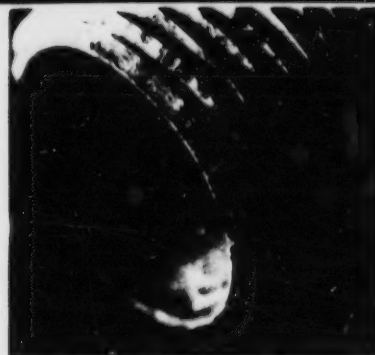
Many northern municipalities use various methods, such as re-circulation systems, insulated piping, burying pipes below the freezing point in the ground (not applicable to areas where permafrost exists), and heat tracing to prevent pipelines from freezing while reducing or eliminating water wastage. Residents too, can take advantage of available equipment and technology to prevent pipe freeze-up while reducing or eliminating the need to keep water running continuously through the pipes. Some of the equipment options available to residents are relatively easy to install. Others are more difficult and best done at the time of house construction or during renovations.

Perhaps the most effective method of preventing pipes from freezing is a dual-line water system to the home. This system keeps water flowing in and out of the home on a continuous basis to prevent freezing. A pump used to circulate the water is contained in a crawl space, utility room or similar location within the home. Another system involves the placement in the home of a storage tank into which water flows. If the water is not used in a pre-set time, it is pumped out of the tank and back into the municipal system. This pump-back reservoir system uses the heat from the home to increase the temperature of the water in the tank, preventing it from freezing when it is pumped back into the supply system.

If your home has a bleeder line installed, consider using a timer. Timers turn the bleeders on and off automatically, and in the event of a power interruption, the line is left open. As well, timers allow you to shut off the flow during the warmer months of the year. Another option available to residents, is in-line heat tracing. This involves running a 1.5 cm (5/8 in.) copper pipe containing electrical heat tape through the supply line.

The heat tape warms the copper pipe, which in turn warms the surrounding water, preventing freezing. In the event of a power failure, the heat tape, once power resumes, can thaw any ice that has formed. Insulating any supply pipes will reduce the amount of heat loss from the water, thus reducing the likelihood of freezing. If pipes are not readily accessible, it is worth insulating exposed pipes and considering insulating the others when renovating. Understandably, installation of in-line heat tracing and pipe insulation are easier to undertake at the time of house construction or during renovation, but an experienced plumber or contractor can complete the tasks with little upset.

There are other options available for reducing water wastage while keeping pipes from freezing, but they are best installed at time of construction or when renovating.



WATER EFFICIENCY IN YOUR HOME

WATER SOFTENERS

Before deciding on the most suitable method to keep your water lines clear and reduce water wastage, be sure to talk to a professional and/or your municipal water works department. There are advantages and disadvantages to the options discussed, so it is important you understand these before undertaking any installation. For more information on preventing frozen pipes and improving water-use efficiency, visit Manitoba Environment's water efficiency web site at www.gov.mb.ca/enviro/prgareas/water/effi.html, or contact your municipality's water works department.

In some parts of Canada "hard" water, caused by the presence of higher than normal concentrations of certain minerals, is treated through the use of water softeners. Water softeners operate by substituting sodium or potassium (salt) for calcium, magnesium or iron minerals that can cause hard water. Water softeners can waste large amounts of water and have other negative impacts.

Problems posed by water softeners

- use large amounts of water resulting in higher water bills;
- increase well water pumping costs;
- corrode pipes, causing more rapid release of lead, if it is present in the plumbing system;
- harm the environment by increasing the soil and water salt content, in turn, harming plant and aquatic life.

If hard water is a real problem in your area, consider using an automatic water softener with a hardness sensor control. By monitoring the hardness of the water leaving the softener, the sensor control activates the softening system only when it is needed. These units save money in the long run by reducing the amount of salt and water used by the system. These types of softeners also have the lowest impact on the environment. For more information about water softeners, visit Manitoba Environment's web site at www.gov.mb.ca/enviro/prgareas/water/effi.html, or contact your municipality's water works department.



OUTDOOR WATER EFFICIENCY

Across Canada, water use more than doubles in the summer months. It is the time of year when we are washing our cars, cleaning and filling our swimming pools, and watering our lawns and gardens. In fact, it is the over-watering of our lawns which wastes the most water. Clearly half the water we put on our lawns is wasted – lost to runoff – and too much water actually damages the health of your grass.

Depending on where you live in the country, you may or may not need to water your lawn. If, like most Canadians, you live in an area that experiences periods of hot, dry weather in the summer, it is more likely than not that you are over watering your lawn. Applying too much water to our lawns weakens the root system of grass, making it vulnerable to disease and pests. Applying a maximum of 2.5 cm (1 in.) of water per week to lawns ensures deep root growth that helps your lawn stay healthy during hot, dry spells. In this chapter, we will discuss the best ways to avoid the problems over watering causes by using water efficient lawn care and landscaping techniques, and we'll look at the many ways we can reduce our outdoor water use.

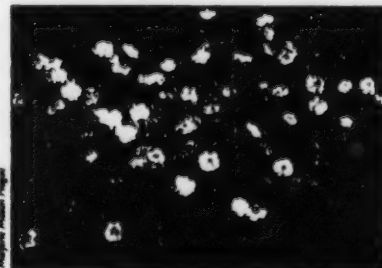
THE BEAUTY OF LOW-WATER LANDSCAPES

When it comes to lawns and gardens, creating water efficient landscapes can also mean creating beautiful, low maintenance landscapes. Bringing about and maintaining a beautiful lawn and garden need not require a lot of water, pesticides, fertilizers and effort. By following the straightforward landscape design principles discussed here, you can ensure your lawn and garden are a pleasure to behold and easy to maintain.

We tend to devote enormous amounts of time and effort to the maintenance of our lawns and gardens. Beautiful lawns and gardens do not have to be a lot of work, if you take into consideration the natural conditions and constructed portions of your property when planning your landscape.

Traditional landscape design creates a constant battle against drought conditions, weed infestation, insect damage, drainage problems, trodden down lawns, and damage due to salt and oily runoff from sidewalks, roads and driveways. By taking advantage of plants which thrive under the various conditions which exist around your property, you can create a landscape that is dynamic, beautiful and easy to maintain.

When we think of low-water plants, we think of cacti. When we think of naturalization, we think of weeds. Nothing could be further from the truth. The pictures of the gardens you see in this chapter are a testimony to the beautiful landscapes you can create using water efficient plants and grasses. It's a little known fact that many commonly available plants require no more water than that supplied by Mother Nature.



Lychnis coronaria, Rose Campion

ADVANTAGES OF WATER EFFICIENT PLANTS AND GRASSES

- Drought-resistant (require little or no watering during hot, dry periods);
- easier and less costly to maintain;
- more resistant to insect infestation and disease;
- many types of plant species to create varied and visually beautiful landscapes;
- excellent for planting in "difficult-to-grow-areas", such as steep slopes and poor quality soils;
- many species are attractive to birds and favourable insects, such as bees and butterflies;
- require little if any use of pesticides and fertilizers.

Water efficient gardening or "xeriscaping", pronounced zair-i-scaping, makes use of the wide variety of low-water demand perennial and annual plants, grasses, vines, trees and shrubs, to create some of the most visually beautiful landscapes you will see. By definition, water efficient, or low-water gardening, is the planting of vegetation suitable to the various conditions that exist around your property.

Xeriscape™

Xeriscape, from the Greek word "xeros", meaning dry and "scape", derived from the word landscape, is a term developed by Denver Water in Colorado, USA, in 1980 to describe water efficient landscaping.

Marjorie Mason Hagan



Sedum spectabile (pink), *Sedum ruta graveolens*, Rue

PRINCIPLES OF WATER EFFICIENT LANDSCAPING

There are three principles of water efficient landscaping, and they are:

1. Develop a landscape plan.
2. Properly prepare and develop the site to be landscaped.
3. Practice proper landscape maintenance.

Be sure you understand the water efficient landscaping principles discussed in this chapter before you begin landscaping your property. The key to creating a landscape design that meets your needs and expectations is knowing how the conditions of your property, the "look" you want to achieve, and intended use relate to site preparation, plant selection and landscape maintenance. The steps outlined under each principle are straight forward and easy to follow — do so, and you will be rewarded with a beautiful, low-maintenance, functional landscape. Keep this guide handy as you plan your landscape, select your plants, trees, shrubs and grasses, and develop your property.

PRINCIPLE 1 - DEVELOPING A LANDSCAPE PLAN

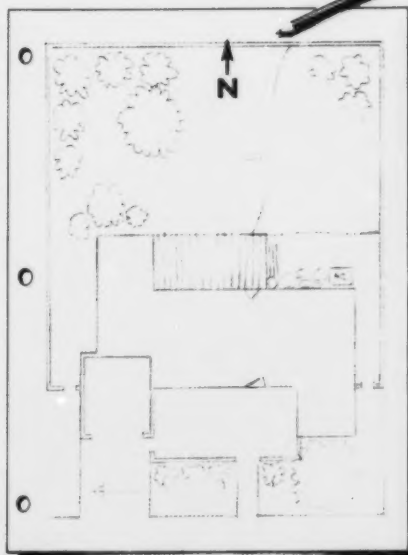
Creating a landscape that is both water efficient and visually attractive, begins with a plan.

The first step toward creating a dynamic, water efficient landscape is to complete a sketch of your property.

You don't have to be an artist to do a basic sketch of your property, but it's a good idea to use graph paper to help keep your drawing as close to scale as possible. If you have a computer, you may want to try some of the new software programs that help you create a landscape design.

Before deciding what and where to plant, it's important to understand the conditions which exist in the area of your property you wish to plant. A properly planned landscape takes into account site conditions. Be sure to include the following in your landscape sketch:

- Exposure
- Existing vegetation
- Soil conditions
- Climatic conditions
- Slope and drainage
- Intended uses
- Grouping vegetation by zone



Making a landscape sketch of your property

LANDSCAPE PLANNING CHECK LIST

- Type of soil conditions around the property;
- typical rainfall during growing season;
- exposure of various areas of the property to sunlight in the warm weather months and cold, windy conditions in the winter months;
- wear and tear expected on different areas of the property;
- exposure of various areas of the property to road salt and car emissions.



EXISTING VEGETATION

Be sure to show on your sketch the location of existing trees, shrubs and other plants. It is a good idea to note directly on the sketch, the type and size of trees, shrubs and ornamental plants that are of particular importance to you. Include on your sketch any existing grass areas. Few of us are in a position, or even want to consider, tearing up our property to start the landscaping process from scratch. Considering what vegetation exists on the site makes it easier to integrate new water efficient design elements into your current landscape.

SOIL CONDITIONS

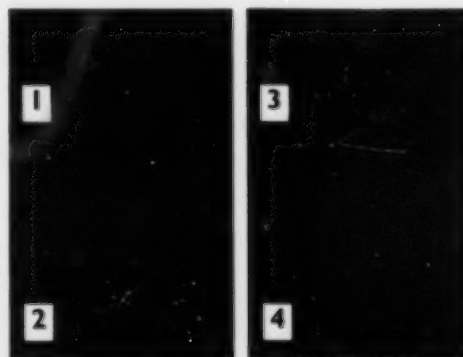
Knowing the soil conditions that exist around your property will help you in developing your landscape plan. Believe it or not, the soil on your property can vary from one section to the next. Understanding those variations will help you to select the plants, trees, shrubs, and grasses appropriate to the specific soil conditions found around your property, and to determine whether or not you

need to recondition your soil to improve its quality.

Keep in mind that the goal of soil improvement should be to provide the best soil conditions for root growth. If you are unsure of the condition of your soil, it's probably worthwhile asking a professional. In some provinces, local agricultural offices will accept a soil sample for analysis.

TAKING A SOIL SAMPLE

- Soil Cast:** Squeeze a small amount of soil in the palm of your hand. (1 and 2)
- Soil Thread:** Gently roll a small amount of soil between your palms. (3)
- Soil Ribbon:** Gently squeeze a small amount of soil between your thumb and forefinger. (4)



SOIL TYPE					
Soil Test	Sandy Loam	Silty Loam	Loam	Clay Loam	Clay
Soil Cast	cast will not break when handled carefully	cast will not break when handled carefully	cast can be freely handled without breaking	cast will endure considerable handling without breaking	cast may be moulded into many shapes without breaking
Soil Thread	thread is readily broken, thick and crumbly	thread is readily broken, thick and soft	thread can be pointed to pencil lead thickness that is readily broken	thread is strong and can be rolled to a pinpoint	thread is strong and elastic and can be rolled to a pinpoint
Soil Ribbon	soil will not form a ribbon	soil will not form a ribbon	soil will form a short, thick ribbon that easily breaks	soil will form a thin ribbon that breaks easily	soil will form a long, thin ribbon that does not easily break

WATER EFFICIENT CANADA

CLIMATIC CONDITIONS

Be sure to show the orientation of your property. A northern exposure means more shade, cooler temperatures and exposure to cold, northerly winds during the winter months. A southern exposure gets full sun throughout the day and is therefore, hotter and drier. It is important to note on your sketch those areas exposed to direct sunlight, wind and precipitation. Identify shady areas on your sketch, because shade has a cooling effect. In fact, a shaded area can be as much as 10°C cooler than an area in full sun, and as a result, there is less water loss from the area due to evaporation. Some plants, particularly low-water species, thrive in hot, dry areas, while others can not tolerate full sun or dry conditions.

SLOPE AND DRAINAGE

It is important to show the slope and drainage of the site on your sketch. Slopes, low-lying areas, ditches, etc., all influence the flow or collection of water on your property. Water flows down slopes and collects in low-lying areas, so it is important that these factors are considered when you develop your landscape plan. To test for drainage, dig a hole approximately half a metre (20 in.) deep and pour in water. If the water seeps out immediately, then your soil is too sandy, and if the water remains in the hole for 24 hours, then your soil contains too much clay. In either case, the addition of organic material will be needed to recondition the soil (see Principle 2 - Site Preparation). When drawing your sketch, be sure to make note of drainage information and use arrows to indicate the downward direction of any slopes.



INTENDED USES

Knowing for what you intend to use the various parts of your property, helps ensure the landscape design meets your needs. Depending on the intended use for an area — a playground for children, a patio for entertaining, a quiet spot for relaxing or sunbathing, an entrance-way, a place for structures or appliances (a tool shed or an air conditioner), or a path for walking — you'll want to select the appropriate landscape design elements.



OUTDOOR WATER EFFICIENCY

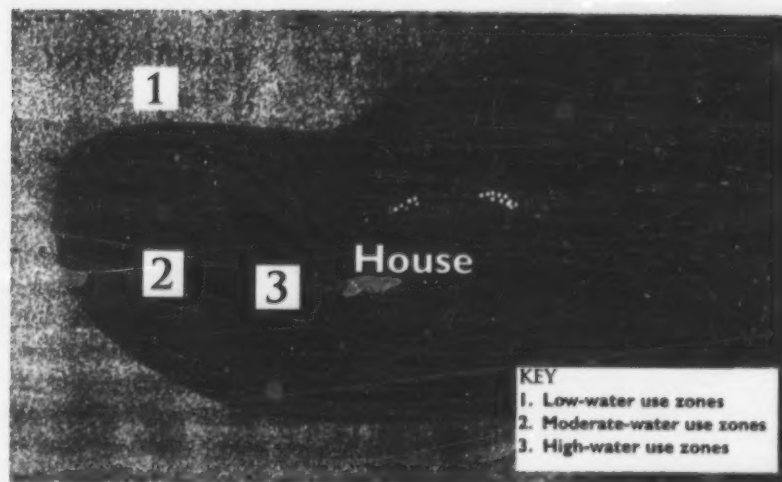
ZONING OR GROUPING OF VEGETATION BY WATER REQUIREMENTS

There are three water use zones for grouping plants. These zones are: low (natural rainfall), moderate (occasional watering) and high (regular watering). By grouping plants according to their water use, you will reduce the chance of damage due to over watering and create a landscape that is easier to maintain.

1. Low-water use zones require little or no additional water after the plant is established. Plants in this zone can be located anywhere, but be sure to use them in spots furthest from your home, where watering is difficult, and in locations that are well drained.

2. Moderate water-use zones contain those plants that require some watering during hot, dry periods. Locate plants in this zone close enough to the home for easy watering during droughts and avoid planting in full sun.

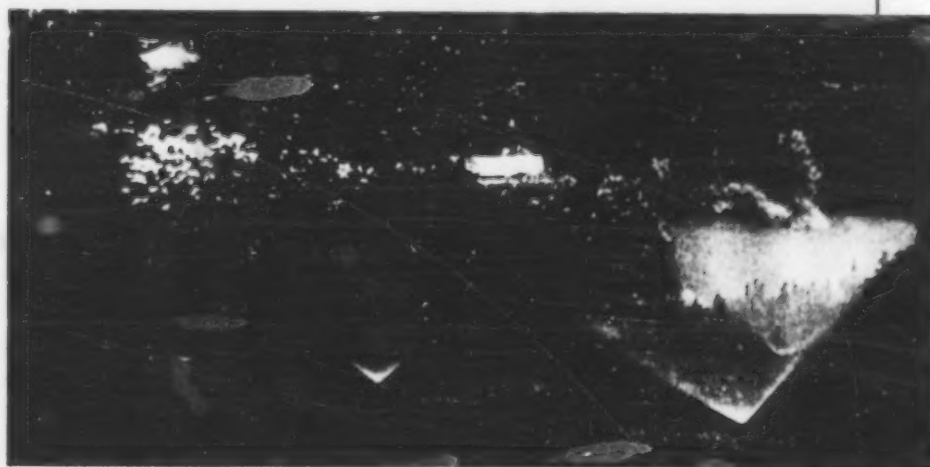
3. High water-use zones are limited areas in the landscape where plants are provided with their optimum water requirements at all times. Traditionally, these are usually the so-called "high impact" or most visible areas



of the landscape, such as the entrance-way to the home. Plants in these zones require a lot more maintenance to keep them healthy and colourful throughout the growing season.

Taking into consideration your budget, the intended use, appearance, location, maintenance and water requirements of your property, you can begin the design

of your water efficient landscape. Keep in mind that local landscape architects, designers and garden centre personnel can be valuable resources and can help you with your planning and design. Remember, it is not necessary to put your new plan in place all at once — you can implement your landscape design gradually, over a period of years.



PRINCIPLE 2 - SITE PREPARATION AND DEVELOPMENT

There are four key steps to preparing your property for planting, they are:

- Step 1** Improving soil quality
- Step 2** Selecting appropriate plants
- Step 3** Selecting the right turf grass
- Step 4** Selecting and locating constructed portions

Whether you are planting one flower or an entire garden, knowing soil conditions and improving them if necessary, selecting the appropriate plants and grasses, and properly planning for constructed areas, are important steps to ensuring success.



Verbena canadensis "Imagination", *Verbena*
A low, trailing perennial providing bright
deep purple and scarlet flowers from
June through October

STEP 1 IMPROVING YOUR SOIL

In developing your landscape plan you should have analysed your soil to assess its condition. If your soil is sandy or contains a lot of clay, you should improve its health by adding organic material. Organic material, such as compost or manure, absorbs and holds water and moderates soil temperatures. If your soil holds more water and maintains a cooler temperature, then your grass and other vegetation is better able to cope during hot, dry weather. One of the best sources of organic material is compost from a home composter. If you don't have enough home compost, use a "natural" fertilizer, such as sheep manure, from your local garden centre.

STEP 2 SELECTING PLANTS, TREES AND SHRUBS

Select trees, shrubs and ground-covers based on their adaptability to your soil and climatic zone. Across Canada, climatic, or plant hardiness zones, range from 0 to 9 (see Plant Hardiness Zone Map of Canada, Appendix 1). Although hardiness ratings are helpful in plant selection, they should be used as a general guide, not an absolute rule. The zone system is based on the minimum

temperatures of a particular area or zone, but it should be remembered that these ratings may not represent the specific conditions that exist around your property. If you find a plant that you would like to have in your garden, but it is not rated for your zone, try experimenting with one or two plants in a protected area of your yard to see how they perform. Be sure to provide winter protection, such as mulch (see "Mulch for Gardens and Beds", page 47).

It is also a good idea to consider using native species – plants naturally adapted to the area – as most need less water, have fewer pest problems and require less fertilizer than many non-adapted, exotic plants. So it is worthwhile considering incorporating some native species into your landscape design. Combining both native plants with water efficient, exotic species creates a beautiful, interesting landscape which conserves water and reduces maintenance requirements.

WATER EFFICIENT PLANT FACTS

- Plants with gray, fuzzy, waxy or finely divided leaves are drought tolerant;
- scented herbs (for example, lavender) produce aromatic oils that prevent the plant from drying out;
- plants with larger leaves generally require more water;
- water plants well until established (usually a full growing season);
- when planting, spread the roots of pot-bound plants for best results.

SELECTING THE RIGHT PLANT

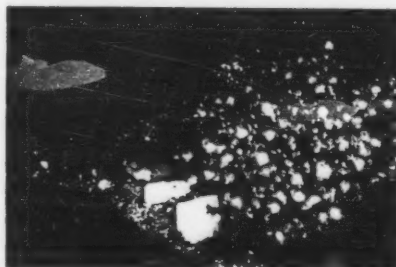
Function and appearance should dictate plant selection. Plants can serve many functions, including: reducing runoff and erosion on slopes, providing shade, acting as windbreaks, attracting birds and butterflies, covering the ground in particularly shady, sunny or hard to plant areas, and providing privacy. Knowing what function you want the plant to serve helps narrow down the selection process.

As important as function, the visual appearance you want to achieve with your landscape should help guide your plant

selection. Height, type and colour of flower, if any, time of flowering (spring/summer/fall), and length of flowering period, are some of the things you may want to consider when selecting your plants. Refer to the chart in Appendix 2 of this guide for recommendations on some water efficient plants that meet your landscape design requirements.

There is an abundant selection of low-water plants – most of which are available at your local garden centre – from perennials and bulbs to annuals and ornamental grasses. You may be surprised to find many of your favourite plants require very little water to flourish. Daylilies, Flax, Pinks, Peonies and Bellflowers are but a few of the many popular perennials that thrive under dry conditions. Readily available annuals, including Cosmos, Sage, Mallow and

California Poppies are drought tolerant and provide season-long colour in your garden. If you prefer to use native species or a mix of native and non-native ornamentals, depending on where you live in Canada, consider planting Purple Coneflower, Black-eyed Susan, Oregon Sunshine, Wild Columbine, Pasque Flower and Evening Primrose. The advantages of native species are; they often attract birds and butterflies, are adapted to the conditions in your region and are not invasive. Whatever your preference, there is sure to be a low-water plant that meets your requirements. For a list of some of the available resources on low-water gardening, native species and landscape design, refer to Appendix 4.



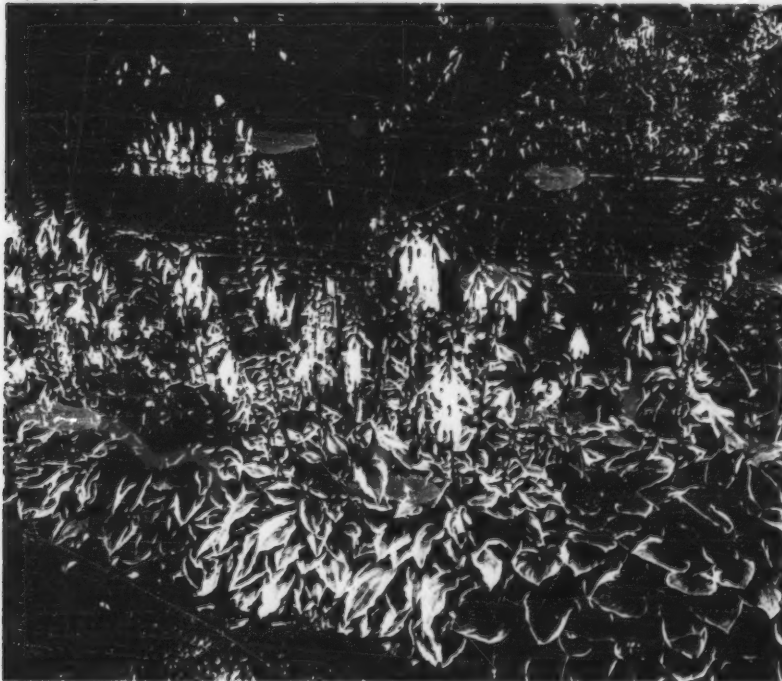
Campanula carpatica, Carpathian Bellflower, form a tight mound and have beautiful bell-like flowers in bloom from June through August.

SELECTING TREES AND SHRUBS

When selecting trees and shrubs, consider the shade the tree will create as it matures. As we have discussed, a shaded landscape is cooler and therefore, retains more water. Shading patios, driveways, walkways and any other surfaces made of concrete, brick or asphalt, prevents those surfaces from radiating heat and increasing water loss from the adjacent landscape. Planting trees

and shrubs along the northern border of your property and adjacent to the north side of your house, provides a natural wind break – particularly important during the cold winter months. On the southern side of your home, deciduous trees and shrubs provide a natural screen from the hot sun during the summer, while allowing in the sun's warming rays in the winter.

Margaret Mason Hagan



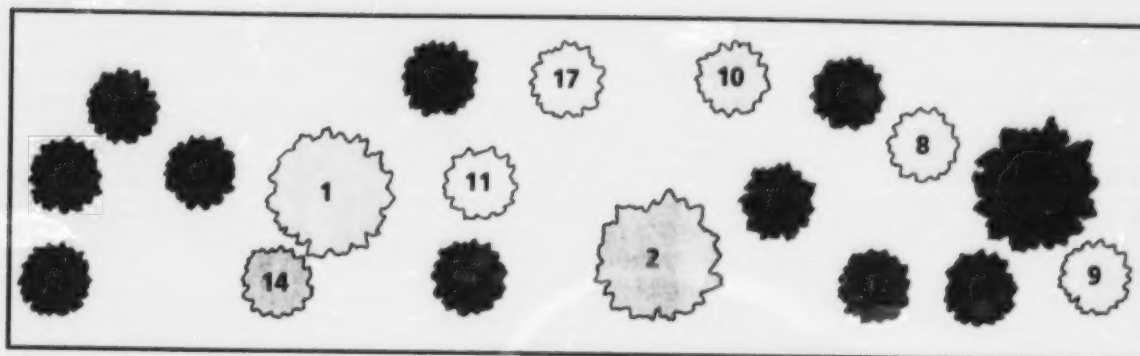
Hosta, Plantain Lily - ideal for shade



*Gaillardia X grandiflora, "Red Plume",
Red Plume Blanket Flower. Scarlet red,
dense flowers blooming June through
September*



OUTDOOR WATER EFFICIENCY



ROCK GARDEN

Size - 4.5m x 1.3m (15' x 4')

1. Juniperus horizontalis, Creeping Juniper
2. Spiraea japonica, 'Little Princess', Little Princess Spiraea
3. Yucca glauca, Soapweed
4. Phlox subulata, Moss or Creeping Phlox
5. Armeria juniperifolia, Juniper Thrift
6. Iris X pumila Hybrids (3 clumps), Dwarf Bearded Iris (variety of types)
7. Veronica filifolia, Speedwell
8. Anemone pulsatilla vulgaris, Pasque Flower
9. Oenothera missouriensis, Ozark Sundrop
10. Alyssum saxatile, Basket-of-Gold
11. Achillea 'King Edward', King Edward yarrow
12. Campanula carpatica, Carpathian Bellflower
13. Dianthus gratianopolitanus 'Tiny Rubies', Tiny Ruby Cheddar Pinks
14. Thymus X citriodorus 'Doone Valley', Doone Valley Lemon Thyme
15. Sedum kamtschaticum, Russian Stonecrop
16. Sedum X 'Bertram Anderson', Bertram Anderson's Stonecrop
17. Linum flavum, Yellow Flax

To fill spaces and for spring and summer bloom:

Annuals

- Cosmos sulphureus 'Ladybird', Ladybird Mexican Aster
- Dyssodia tenuiloba, Dahlberg Daisy
- Phacelia campanularia, California Blue Bell
- Portulaca grandiflora, Rose Moss
- Zinnia angustifolia, Mexican Zinnia

Bulbs

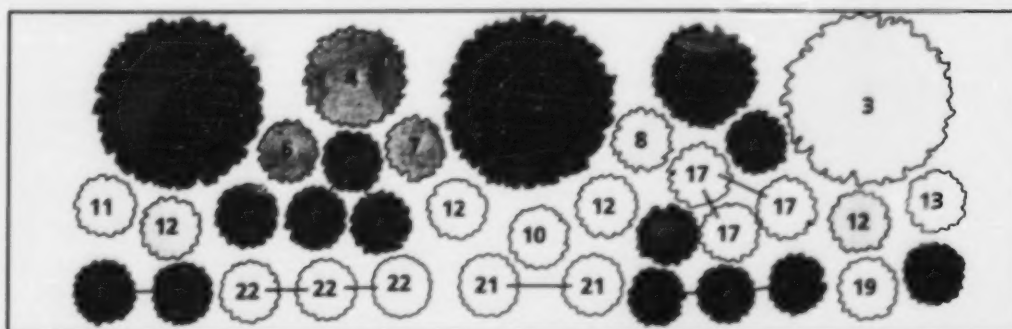
- Allium oreophilum, Ostrowsky Onion
- Scilla sibirica, Siberian Squill
- Tulipa tarda, Tarda Tulip

Sara Williams



Rock gardens are ideal for difficult to plant slopes and banks. They reduce erosion and runoff.

WATER EFFICIENT CANADA



BORDER

Size - 4.5m x 1.5m (15' x 5')

1. *Viburnum lantana*, Wayfaring Tree
2. *Rosa rugosa*, Rugosa Rose
3. *Philadelphus lewisii*
'Waterton', Waterton Mock Orange
4. *Miscanthus sinensis*
'Gracillimus', Maiden Grass
5. *Calamagrostis X acutiflora*
'Karl Foerster', Karl Foerster's Reed Grass
6. *Liatris spicata*, Blazing Star
7. *Anthemis tinctoria*, Golden Marguerite
8. *Eryngium planum*, Blue Sea Holly
9. *Iris X germanica*, Tall Bearded Iris
10. *Helictotrichon sempervirens*, Blue Oat Grass
11. *Artemisia 'Valerie Finnis'*, Valerie Finnis Sage
12. *Hemerocallis Hybrids*, Daylily (variety of types)
13. *Achillea X 'Moonshine'*, Moonshine Yarrow
14. *Nepeta xucranica*
'Dropmore', Dropmore Catmint
15. *Echinacea purpurea*, Coneflower
16. *Gaillardia X grandiflora*
'Burgundy', Burgundy Blanket Flower
17. *Ratibida columnifera*, Prairie Coneflower
18. *Sedum spectabile*, Autumn Joy Sedum
19. *Oenothera tetragona*, Yellow Sundrops
20. *Veronica X 'Goodness Grows'*, Goodness Grows Speedwell
21. *Coreopsis verticillata*
'Zagreb', Zagreb Thread-leaved Coreopsis
22. *Stachys byzantina*, Lamb's Ear
23. *Bergenia cordifolia*, Heartleaf Bergenia

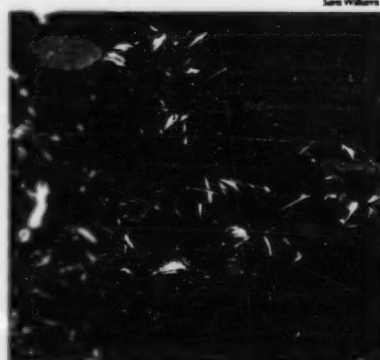
To fill spaces and for spring and summer bloom:

Annuals

- *Helianthus annuus*, Sunflower
- *Cleome hasslerana*, Cleome or Spider Flower
- *Cosmos bipinnatus*, Cosmos
- *Salvia sclarea*, Clary Sage

Bulbs

- *Allium aflatunense* 'Purple Sensation', Flowering Onion (Purple Sensation)
- *Narcissus*, Daffodil
- *Tulipa* species, Tulips (various types)



Hemerocallis 'Karen Lynn', Daylily

DRIVEWAY STRIP

Size - 4.5m x 1.5m (15' x 5')

1. *Pinus mugo pumilio*, Mugho Pine
2. *Rosa rugosa*, Rugosa Rose
3. *Spiraea X bumalda* 'Goldflame', Goldflame Spirea
4. *Juniperus sabina* 'Tamariscifolia', Tamarix Savin Juniper
5. *Potentilla fruticosa* 'Pink Princess', Pink Princess Bush Cinquefoil
6. *Helictotrichon sempervirens*, Blue Oat Grass
7. *Yucca filamentosa*, Spanish Dagger
8. *Sedum X 'Vera Jamieson'*, Vera Jamieson's Stonecrop
9. *Gaillardia X grandiflora* 'Red Plume', Red Plume Blanket Flower
10. *Geranium X cantabrigiense*, Geranium (Alpine or border type)

11. *Oenothera missouriensis*, Ozark Sundrops
12. *Hemerocallis* Hybrids 'Stella de Oro', Stella de Oro Daylily
13. *Cerastium tomentosum*, Snow-in-Summer

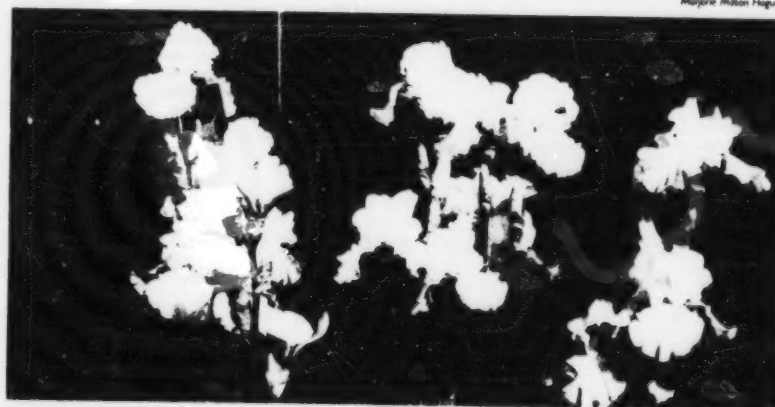
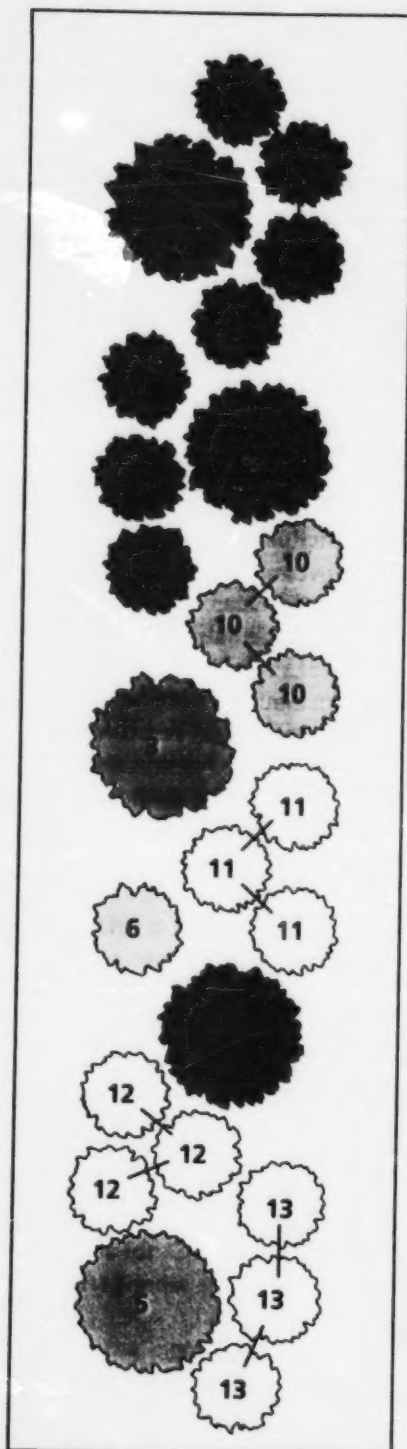
To Fill Spaces and for Spring & Summer Bloom:

Annuals

- *Verbena X Hybrids*, Summer Verbena
- *Eschscholzia californica*, California poppy

Bulbs

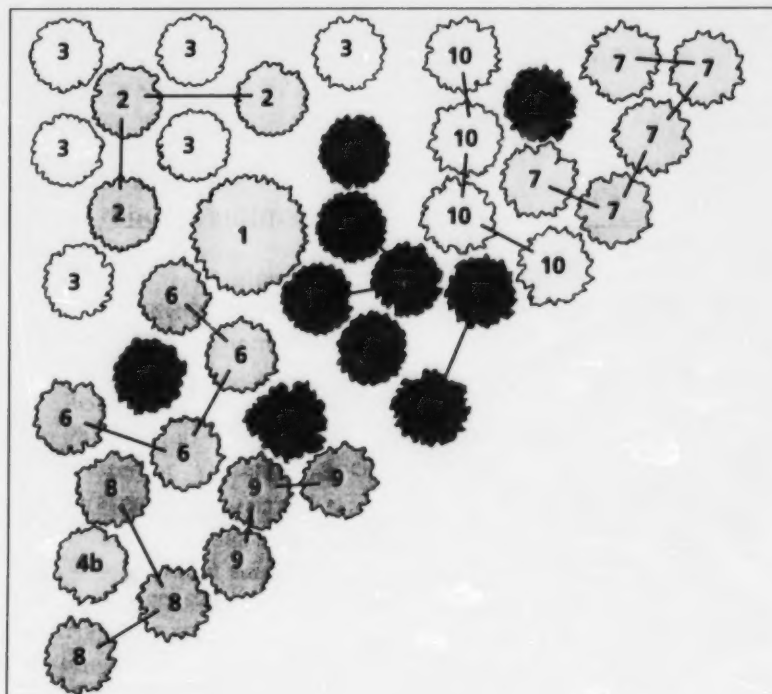
- *Narcissus*, Daffodil
- *Tulipa* species, Tulips (various types)



Iris X germanica, Tall Bearded Iris

SHADY CORNER

Size - 3m x 3m (10' x 10')



1. *Elaeagnus angustifolia*, Russian Olive
2. *Dicentra spectabilis*, Old-fashioned Bleeding Heart
3. *Geranium macrorrhizum*, Geranium (border type)
- 4a. *Hosta 'Royal Standard'*, or other green-leaved Hosta
- 4b. *Hosta 'August Moon'*, or other gold-leaved Hosta
- 4c. *Hosta 'Albo-marginata'*, or other variegated Hosta
5. *Epimedium X rubrum*, Rubrum Barrenwort
6. *Lamium galeobdolon 'Herman's Pride'*, Herman's Pride False Lamium
7. *Lamium 'White Nancy'*
8. *Heuchera americana 'Ruby Veil'*, Ruby Veil Coral Bells
9. *Aruncus aethusifolius*, Dwarf Korean Goatsbeard
10. *Tiarella wherryi*, Foamflower
11. *Luzula sylvatica*, Greater Wood Rush

For Spring Bloom:

Bulbs

- *Anemone blanda*, Grecian Windflower
- *Scilla campanulata*, Squill

Tulipa species, Tulips



OUTDOOR WATER EFFICIENCY

STEP 3 SELECTING THE RIGHT GRASS

When considering a landscape's water requirement, it is important to note that some turf grasses, commonly referred to as lawn grass, are better adapted to the region in which you live. Carefully select grass adapted to your area and according to its intended use, planting location and maintenance requirements.

Where you live in Canada will dictate the type of grass or grasses you should use. Some grass species thrive in areas with hot, dry summers and cold winters, such as the Prairies, while others do better where temperatures are more moderate year around. Most new varieties of grass require less moisture and fertilizer and have greater built-in resistance to pests. The best approach when re-seeding or rejuvenating your lawn is to speak with a lawn care professional and find a mix of new grass varieties, or mix your own, using those best suited to the conditions around your yard. Where possible, select a mix of grasses to strengthen your lawn's resilience – reducing its susceptibility to disease and pests. For a list of grasses suitable to your area, refer to the table, Turf Grasses for Canadian Lawns, in Appendix 3.

Function is the biggest consideration when deciding where to plant grass. Instead of thinking about the traditional

lawn, consider using grass only where it will provide the most functional benefit, such as recreational areas. Selecting where to lay grass should be part of your landscape planning and design process. Grass should not be used to blanket your property, but should be kept to a minimum and complement your landscape in both function and appearance. It is important to separate grasses from garden plants and to try to keep grass close to a water source (so it may be watered separately), or in a shaded area where minimal watering is required. It is also important to select the right grass for the area you are planting.

One of the main reasons people have problems with their lawn, such as weed infestation, insect damage and wilting, is because they are planting the wrong grass in the wrong location. Be sure to get a lawn care professional at a local nursery to help you select the right grass for those sections of your landscape where you want lawn. You may also wish to consider alternative ground covers, such as thyme, for some areas of your property typically reserved for lawns. Another option, is to try naturally drought tolerant grasses, such as Buffalo Grass or Tall Fescue which create a beautiful, dense lawn requiring little, if any, water once established.

Warren Schultz



Perennial Rye Grass

Warren Schultz



Tall Fescues

Warren Schultz



Fine Fescues

Keep grass to a minimum and plant only where it will be utilized, such as a play or leisure area.

STEP 4 SELECTING AND LOCATING CONSTRUCTED PORTIONS

Just as the selection and location of plants and grasses is important to the overall water efficient landscape design, so too is the selection and location of constructed surfaces. If you are installing a new driveway, walkway or patio, or replacing an existing one, consider using interlocking brick or flagstone in place of concrete or asphalt, to reduce runoff and increase the amount of water that infiltrates the ground. Remember these surfaces tend to radiate heat and increase evaporation from the landscape, so it is a good idea to keep their use to a minimum or to shade these areas to keep the surfaces cool.



Thymus spp., Thyme softens the look of brick, flagstone or concrete.

PRINCIPLE 3 - LANDSCAPE MAINTENANCE

A properly maintained landscape ensures that whatever your landscape design, it is healthy and less dependent on water and fertilizers. Knowing how to water your lawn, where to use mulch in your garden and the best mulches to use, when to "top-dress" your lawn and other maintenance strategies, will ensure your lawn and garden look their best throughout the growing season.

WATERING EFFICIENTLY

Most of the water we apply to our lawns and gardens is not taken up by the plant, but rather, is lost to runoff or evaporation. Watering too much and too often wastes water and can damage the plant. Over watering not only weakens the plant's root system, making it vulnerable to pests and disease, it carries nutrients down into the soil and away from the plant's roots. Add to this, the fact that minimum watering (2.5 cm or 1 in. per week) ensures deep root growth and stronger, healthier vegetation, it's easy to understand the benefits of efficient watering.

Watering systems, or as they are called in the landscaping business, irrigation systems,

should be designed to meet the needs of your property and budget. It may be that all you require is a "soaker" hose and a couple of water efficient sprinklers. More complex systems, such as drip or trickle irrigation may be an option, depending upon the size of your property, its layout and your budget. Drip irrigation delivers small amounts of water via flexible plastic tubes to the roots of plants. Drip irrigation systems are more efficient, ideal for watering plants in gardens and should be used for moderate to high water zone plant groupings. It is a good idea to secure drip lines to the soil surface and cover them with organic mulch to protect them from the sunlight and improve the garden's appearance.

Sprinklers, above or in-ground, spray droplets of water in a steady, rotating or alternating motion. When using sprinklers,

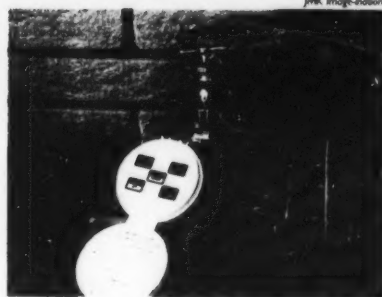


Whatever the watering system you have in place, following a few simple practices when watering your lawn will help you achieve a healthy lawn and water savings.

you can avoid both excessive water loss due to evaporation and burning of plant leaves from water magnifying the sun's rays, by watering in the early morning before 9 a.m. Try to limit your watering to calm days with little or no wind to prevent wind-drift.

WATERING FOR A HEALTHY LAWN

Most lawns receive far more water than they require for a healthy appearance. The key to watering lawns is to apply the water infrequently, yet thoroughly. This creates a deep, well-rooted lawn that efficiently uses water stored in the soil. To know when to water the lawn, simply observe the grass. At the first sign of wilting and discoloration, apply 2.5 cm (1 in.) of water to the lawn. If you are not comfortable with the "lookout" method of lawn watering, try applying 2.5 cm (1 in.) of water each week. To determine how long to water your lawn to apply 2.5 cm (1 in.) of water, place an empty tuna fish can on your lawn as you run the sprinkler, when it's full, you've applied the right amount of water. To make this weekly watering process easier, try using a timer on your sprinkler (look for timers with 28-day settings). Time how long



Sprinkler Timer

it takes for the can to fill to the rim and set your sprinkler timer appropriately, but keep in mind some sprinklers require only minutes to fill the can. Remember 2.5 cm (1 in.) of water a week, before 9 a.m. ensures a healthy, deep-rooted lawn.

WATERING TREES, SHRUBS AND ORNAMENTAL PLANTS

All vegetation, whether it's a tree or a small flowering plant, requires more regular watering from the time you plant them until they are well-rooted. Depending on what you plant, it can take one month to several growing seasons before the roots are well established. Your local garden centre can help you in determining the establishment time of the vegetation you select, but the general rule of thumb is that most plants and vines take one growing season to establish, while some trees and shrubs require two or more seasons to fully establish. Once the plants

are established however, they can be weaned to the point where they require little or no water other than that provided by Mother Nature. By properly weaning plants they develop deeper root systems and become more drought tolerant.

To properly water trees or shrubs, until they are established, direct water to the root system. The root system of trees and shrubs is located within the top 30 cm (12 in.) of the soil and beyond the "dripline" of the plant. The dripline is the area directly below the outer tips of the branches. Apply water and, when needed, fertilizer, around and beyond the dripline of trees and shrubs.



Dripline of trees and shrubs

WATER EFFICIENT CANADA

Do not water or fertilize at the trunk. An easy way to water trees is to place a perforated hose (a flat hose with tiny holes) around the dripline until the area is saturated to a depth of 20 to 25 cm (8 to 10 in.). Remember to water before 9 a.m. to reduce water loss due to evaporation.

Installing rain barrels at the downspouts of your eaves troughs is a great way to collect rainwater to use on your lawn and garden, and just as importantly, an excellent means of preventing drainage problems around your home's foundation. Make sure you purchase a rain barrel with a screened lid, childproof top, overflow mechanism and a hose attachment for watering. Remember to drain rain barrels before winter to prevent freezing.



Rain Barrel

LAWN & GARDEN WATERING TIPS

1. Set your sprinkler to avoid watering patios, drives and walks.
2. Water back from the tops of slopes, as water will run down the slope and seep into the soil.
3. Sweep your driveway and walkway instead of washing with a hose.
4. Recoil your hose on a hose wheel to prevent damage.
5. Regularly check your hose for leaks.

MULCH FOR GARDENS AND BEDS

Mulch is a must for any water efficient landscape. Mulch is a protective covering of non-living material used on soil surfaces around plants. Mulch keeps soil cool and moist, controls erosion and discourages weed growth. Mulch is either organic; derived from living material, or inorganic; derived from non-living material. Organic mulches, such as pine bark, shredded cedar, straw and wood chips make the best covering for soil. Inorganic mulches, such as lava rock, gravel and limestone retain more heat, increasing water loss from the landscape. Any mulch is better than no mulch at all, so if you

want to use stone mulch, stick to the more neutral colours, like beige or light gray, since white rocks create glare and black ones absorb more heat. Permeable plastic or landscape fabric (a mesh with small perforations that allow water to flow through), can be placed under organic mulches to help retain moisture in the soil while still allowing water, nutrients and air to penetrate. A good time to apply mulch is in the fall — this reduces the freezing and thawing of soil during the winter months.



Mulch helps keep soil cool and retain its moisture

FERTILIZING TREES, SHRUBS AND ORNAMENTAL PLANTS

Water efficient trees, shrubs and ornamental plants require little, if any, fertilizer. Lightly working compost or manure into the soil in the spring, prior to replenishing the mulch, is more than sufficient to keep plants healthy. Water droplets and worms do most of the work of getting the nutrients down to the root level where the plants can absorb them. Plants go dormant in the fall, so it isn't necessary to fertilize at that time of the year.

MAINTAINING YOUR GRASS

One of the keys to a healthy lawn is proper maintenance. A well-maintained lawn means healthy soil and deep root growth – conditions necessary to handle drought, reduce pest and weed infestation, and prevent disease.

MOWING LAWNS

Mowing is one of the most important things you do to your lawn. Most people tend to mow too often and to cut the grass too short. For typical grass species, mowing grass to a height of 6 to 8 cm (2.5-3 in.), and never cutting more than one-third of the grass length, will encourage longer roots and shade the soil — reducing

its temperature and the loss of moisture due to evaporation. To help maintain the moisture and temperature levels of soil during long periods of hot, dry weather, raise the mowing height by 25 to 50 per cent. To determine the best height at which to cut you grass, refer to the table, "Turf Grasses for Canadian Lawns", located in Appendix 3.

Another way to ensure vital nitrogen is supplied to your lawn is to leave grass clippings on the ground after mowing. Clippings can provide more than half a kilogram of nitrogen for every 100 sq. m (1 lb. for every 1000 sq. ft.), of lawn. Leaving clippings on the lawn does not contribute to thatch. Organisms in the soil will begin to break down the clippings within a week. Understandably, this process will be slower on lawns where insecticides and herbicides have been used. In the case where chemicals have been used on the lawn, you'll want shorter clippings to help facilitate the breakdown of the grass. This means mowing more often or using a mulching mower. If your grass is very long, cut it first with your mower height raised so you cut no more than one-third of the grass blade. Slowly



lower the mower height the next time(s) you cut the grass, until the desired grass length of 6 to 8 cm (2.5 to 3 in.), is achieved. In cases where the grass is extremely long, you may need to rake up the clippings and compost them.

LAWN MOWING TIPS

1. Keep the blades of your mower sharp; dull blades tear the grass leaving it open to disease and heat stress.
2. Alter the direction you mow each time you cut the grass.
3. Avoid cutting the grass when it is wet.
4. Set mower height to cut grass no lower than 6 to 8 cm (2.5 to 3 in.) - for most grasses.
5. Leave grass clippings on the lawn as they are an excellent source of nitrogen.

FERTILIZING LAWNS

Lawns, unlike other vegetation, should be fertilized once a year, in the spring or fall, to ensure deeper roots, denser growth and a greater resistance to weeds, disease and hot weather stress. A key component of fertilizers is nitrogen, and most chemical lawn fertilizers contain, water-soluble nitrogen. The nitrogen in these chemical fertilizers dissolves in water and is carried away, therefore constant reapplication is necessary to provide the required nitrogen. Most natural fertilizers contain insoluble nitrogen that does not readily dissolve in water. Natural fertilizers stick around in the ground for a long time and soil acids and micro-organisms slowly convert the nitrogen into a form that plants can use.

Natural Sources of Nitrogen

- cow manure
- bloodmeal
- fish emulsion
- mixed organic fertilizers
- bone meal
- dried poultry manure



The other nutrients which are essential to maintaining a healthy lawn are phosphorous and potassium. Phosphorous helps the early formation and development of the roots. New grass, therefore, requires higher levels of phosphorous. Potassium strengthens grass, giving it resilience, helping to maintain its general health. Dried poultry manure and mixed organic fertilizer, such as compost, provide natural sources of both of these essential nutrients.

Fertilizers are identified by three numbers, usually clearly visible on the front of the container, which represent the nitrogen-phosphorous-potassium ratio by weight of fertilizer. For example, a fertilizer with the numbers 12-9-9 contains 12 per cent nitrogen, 9 per cent phosphorous and 9 per cent potassium by weight. So if the bag of fertilizer weighs 20 kg (44 lb.), 12 per cent of 20 kg (44 lb.) gives you the amount of nitrogen in the fertilizer. In other words, there are 2.4 kg (5.2 lb.) of nitrogen

in the bag of fertilizer. The same method of calculating is used for the imperial measurement of nitrogen. For the spring select a 15-9-9 fertilizer and, should you want to fertilize in the fall, although it is not necessary, choose a 9-9-9 fertilizer. Nitrogen stimulates growth which is not desired as winter approaches, but is obviously the goal of spring fertilizing.

The rule of thumb is to use half a kilogram of nitrogen for every 100 sq. m of lawn (or 1 lb. for every 1000 sq. ft. of lawn). The best conditions for fertilizing are when rain is forecast, soon after aeration, and when there is low wind. Be sure to avoid fertilizing during times of drought.

It's important not to over fertilize your lawn because too much fertilizer causes your grass to grow beyond the limits of the soil and the watering regime. The more fertilizer, the more water and lawn mowing required.



Fertilizing is best done in spring.



AERATING LAWNS

Aerating is used on lawns to physically remove a core of soil and turf. Soils often become compacted over time, particularly on chemically treated lawns, because natural soil aerating organisms like earthworms and micro-organisms have been depleted or eliminated. Aeration helps give soil a fresh start by reducing compaction, improving water penetration, drying wet soils and helping oxygen and organic materials to reach the roots, thereby maximizing the uptake of nutrients by the grass. Aerating can be done in the early spring or fall; and when combined with top-dressing, fertilizing and overseeding; it will amend and improve the soil.

THATCH AND YOUR LAWN

Thatch is a layer of entrenched decomposing grass between the soil and live grass. Thatch is beneficial to healthy growing grass, providing insulation from heat and evaporation. Thatch also inhibits weed seed germination, shades soil and acts as a cushion for grass, which in turn increases your lawns tolerance to wear and tear.



Aerating should be done once a year. Arrange with your neighbour to share the cost of renting the aerator for a day.

Too much thatch can reduce water penetration and block the movement of oxygen and nutrients into the soil. Thatch only becomes a problem when it exceeds 15mm (1/2 in.) in thickness. By fertilizing and watering moderately, you can avoid excessive thatch in your lawn.

Dethatching, removing excess thatch with a thatch or fan rake, is best done in the fall. If done in the spring, dethatching can damage the roots of the grass.

TOP-DRESSING LAWNS

After aerating, in early spring or fall, is the ideal time for top-dressing your lawn.

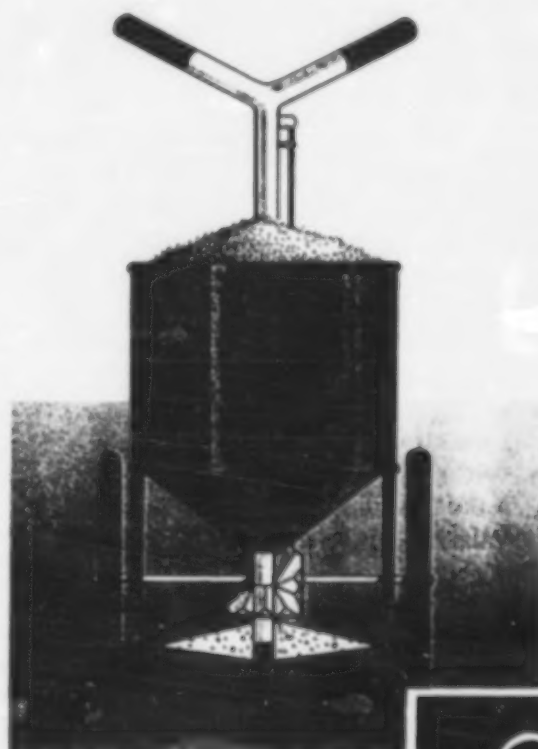
Top-dressing is simply the application of a thin layer of organic material to your lawn. The addition of organic material makes your lawn healthier because it increases the ability of the soil to retain moisture and nutrients. You can use a home-made top-dressing if your composter produces enough compost. Be sure to sift your compost using a screen made of 2 cm (1/2 in.) hardware cloth, or chicken wire framed with wood. Another option is "triple mix", a readily available form of top-dressing containing a mixture of top soil, manure and compost. Using a shovel, apply compost or triple mix to your lawn to a maximum depth of 15 mm (1/4 in.), and rake to distribute evenly.

OVERSEEDING LAWNS

Overseeding is adding more grass seed to thicken and improve your lawn. It also allows the introduction of more compatible turf species to your lawn, such as a mix of fescue grasses, which are well suited to many regions in Canada and are drought tolerant. Look for pest-resistant varieties that contain Endophytic fungi, a naturally occurring type of fungus that actually resists disease and lawn pests. Overseeding can be done at the same time as top-dressing, fertilizing and aerating, and is best done in the early spring or fall.

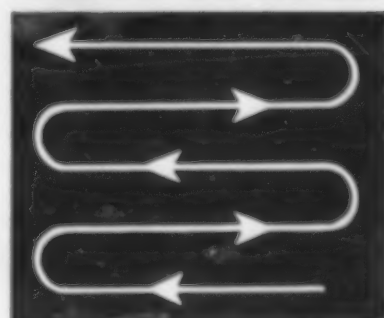
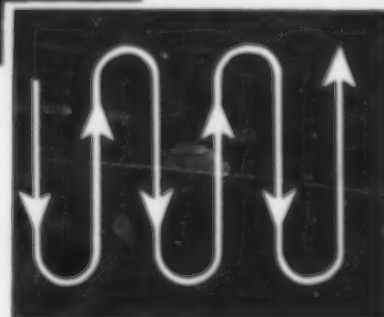
KEEPING WEEDS AND PESTS OUT OF YOUR LAWN AND GARDEN

If you follow the lawn and garden maintenance practices discussed in this chapter, chances are you should not require any type of synthetic chemical pesticide. It is well documented that healthy lawns and gardens out-compete most weeds and pests. Using mulches in gardens and proper fertilizing, top-dressing and overseeding for lawns should eliminate the need for anything other than some light hand-weeding. By monitoring



Seed Spreader

your lawn and garden, you can keep an eye out for harmful pests. If damage is evident and obvious, and you can rule out environmental causes such as improper drainage, road salt, car exhausts or dog damage, then use the most selective, least harmful pesticide available for the job. Be sure to seek the advice of a landscape professional at your local garden centre before selecting and using any pesticide.



Pattern to follow when overseeding lawns



OUTDOOR WATER EFFICIENCY

CUTTING DOWN ON OTHER OUTDOOR WATER USES

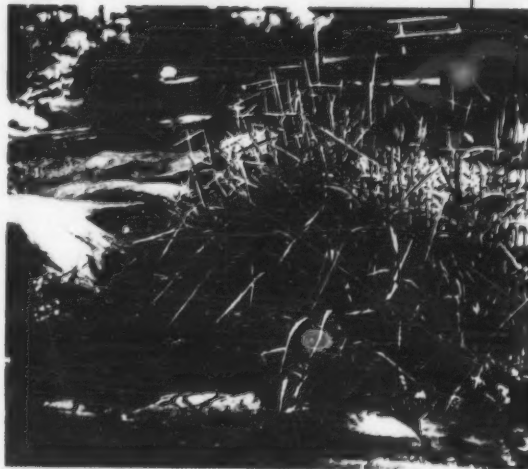
Our lives tend to move outdoors during the warm summer months and consequently, so too does our water use. Although watering lawns and gardens accounts for most of our water use in the summer, activities such as washing our cars, filling our swimming pools and cleaning our windows, use significant amounts of water. By following the outdoor water saving tips below, you can still do all those water-based activities, but you'll use less water and, in the process, save money on your monthly water bill.

OTHER OUTDOOR WATER SAVING TIPS

1. Apply a maximum of 2.5 cm (1 in.) per week of water to your lawn.
2. Use a bucket and sponge to wash and rinse your car so you will only need a light rinse to get rid of the soap.
3. Sweep drives and walks instead of using a hose.
4. Cover swimming pools when not in use to reduce evaporation.
5. Squirt guns or small plastic containers filled with water are as effective at keeping children cool on a hot day as running a sprinkler.
6. Use a bucket and squeegee to wash windows.
7. Operate decorative fountains only when you're there to enjoy them.
8. When cleaning outdoor ornamental ponds, use waste water to water lawns and gardens.



Steve Williams

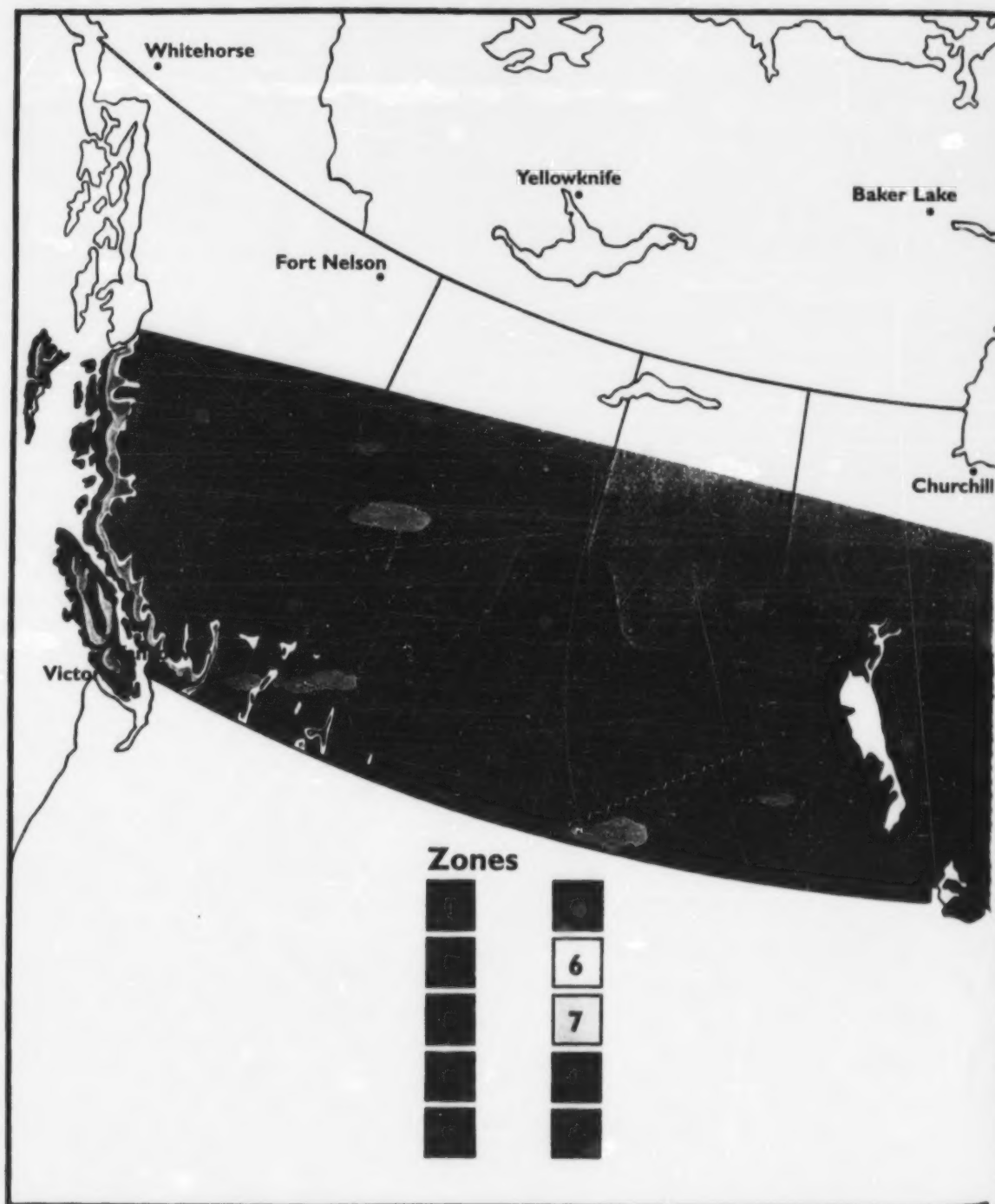


Phalaris arundinacea, Ribbon Grass

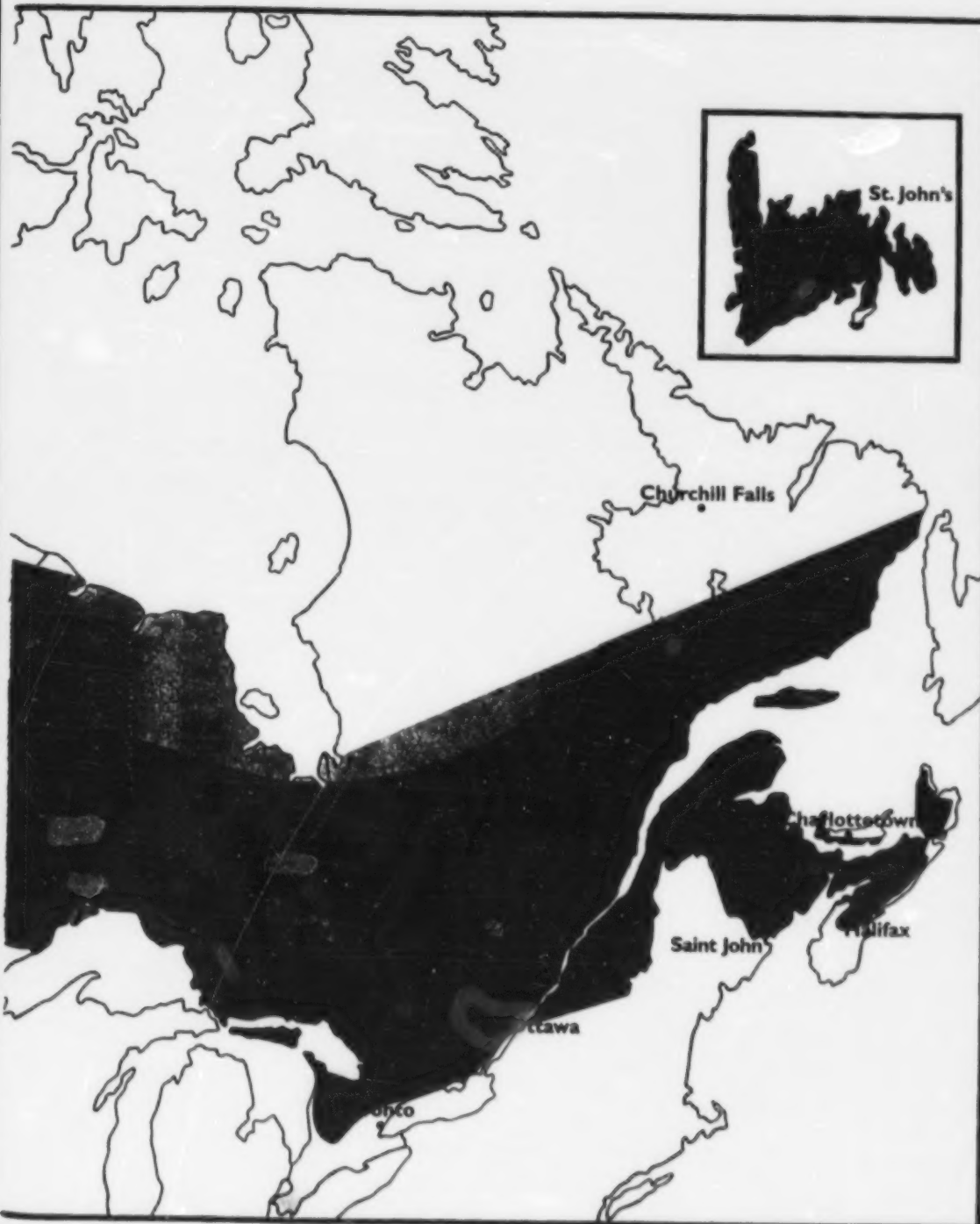


Dictamnus albus, Gas Plant

Plant Hardiness Zone Map of Canada



APPENDIX I



WATER EFFICIENT CANADA

A SELECTION OF WATER EFFICIENT PLANTS, TREES AND SHRUBS

PLANT	USE	EXPOSURE	SOIL
(Plant Hardiness Zone)			
PERENNIALS:			
Achillea species Yarrow (3-9)	borders, massing		average, well-drained
Allium species Flowering onion (3-9)	beds, borders, rock gardens, edging		average, well-drained
Armeria maritima Sea Thrift (3-9)	rock gardens, edging, massing		well-drained
Bergenia cordifolia Heartleaf Bergenia (3-8)	rock gardens, edging, massing	 	moist to well-drained
Campanula rotundifolia Bluebell, Harebell (2-9)	borders, rock gardens, naturalizing	  	well-drained
Dianthus species Pink (3-9)	borders, rock gardens, edging		average, well-drained
Eryngium species Sea Holly (4-8)	borders, filler, accent		well-drained to dry
Gaillardia grandiflora Blanket Flower (3-8)	borders, meadows		well-drained to dry
Hemerocallis species Daylily (4-9)	borders, massed, naturalizing, tall ground cover	  	well-drained
Heuchera sanguinea Coralbells (4-8)	borders, massing, tall ground cover		well-drained
Iris species Bearded Iris (4-9)	borders, rock gardens, edging		well-drained
Liatris punctata Gayfeather (4-9)	beds, borders, accent plant, foundation		well-drained
Lychnis coronaria Campion (4-8)	borders, meadows		average, well-drained
Linum perenne Blue Flax (2-8)	borders, meadows, naturalizing		well-drained
Oenothera missouriensis Missouri Primrose (4-9)	borders, rock gardens		well-drained
Yucca filamentosa Spanish Dagger (5-9)	accent plant in beds and borders; slopes, massed, rock gardens		well-drained
Full Sun 		Partial Shade 	Full Shade 



APPENDIX 2

HEIGHT	COLOUR	SEASON OF BLOOM	WORTH NOTING
30 - 60 cm (1 - 2 ft.)	yellow	summer - fall	- divide every 2-3 years - attracts butterflies
25 cm - 1m (10 in. - 3 ft.)	purple, blue (depending on variety)	spring - fall	- taller varieties for back of bed/border; smaller varieties for rock gardens/edging
15 - 20 cm (6 - 8 in.)	rosy-red	spring - early summer	- fertilize only with bonemeal, too much fertilizer reduces number of blooms
38 - 45 cm (15 - 18 in.)	pink, red	spring	- plant in site that does not receive direct afternoon sun
15 - 60 cm (6 in. - 2 ft.)	blue	early summer - fall	- remove older plants (2 to 3 years)
10 - 45 cm (4 - 8 in.)	pink, white, red, soft yellow	spring - fall (depending on variety)	- evergreen, do not cut plant back
60 cm - 1m (2 - 3 ft.)	blue, silver	summer	-requires good winter snow cover or protection
15 cm - 1m (6 in. - 3 ft.)	yellow, orange, red, purple	summer - fall	- divide every three years - prefers hot, dry locations
45 cm to 1m (1.5 - 4 ft.)	yellow, purple, pink, bronze, orange, red	spring - fall (depending on variety)	- select early-, mid- and late blooming varieties for colour throughout the season
30 - 60 cm (1 - 2 ft.)	pink, red, white	spring - summer	- deadhead for extended bloom
60 cm - 1m (2 - 3 ft.)	white, yellow, pink, purple, orange, blue	early spring	- large, dominating foliage persists into fall, so use selectively in gardens
15 - 60 cm (6 in. - 2 ft.)	lavender	summer	- <i>L. spicata</i> is more attractive, but requires more moisture
20 - 90 cm (8 in. - 3 ft.)	white, pink	summer	- deadhead to extend bloom - attracts hummingbirds
30 - 45 cm (1 - 1.5 ft.)	blue	late spring - summer	- readily self-seeds
30 - 45 cm (1 - 1.5 ft.)	yellow	summer	- <i>O. tetragona</i> is better suited to borders, as it is more upright with larger flowers
60 cm - 1m (2 - 3 ft.)	white	summer	- evergreen, do not cut back leaves

WATER EFFICIENT CANADA

PLANT (Plant Hardiness Zone)	USE	EXPOSURE	SOIL
PERENNIAL GROUND COVERS:			
Artemisia species	rock gardens, edging, accent		average, well-drained
Wormwood (4-9)			
Cerastium tomentosum	slopes, trailing		well-drained
Snow-in-summer (5-9)			
Delosperma cooperi	rock gardens, edging, slopes, paths		well-drained to dry
Pink hardy ice plant (5-9)			
Phlox subulata	rock gardens, edging, trailing, paths		well-drained
Moss or Creeping Phlox (3-9)			
Sedum species	rock gardens, edging, paths		well-drained
Stonecrop (4-9)			
Thymus species	rock gardens, edging, paths		well-drained
Thyme (4-9)			
ANNUALS:			
Argemone species	borders		sandy soil
Mexican poppies			
Cleome hasslerana	rear of borders, centre of		well-drained
Cleome, Spider Flower	island beds, accent plant		
Cosmos bipinnatus	borders, massing, meadows		well-drained
Common Cosmos			
Dyssodia tenuiloba	borders, edging, rock gardens, trailing		well-drained
Dahlberg daisy			
Eschscholzia californica	borders, beds, meadows, naturalising		well-drained
California Poppy			
Helianthus annuus	accent plant, summer hedge,		average to poor soil
Sunflower	back of tall bed		
Salvia farinacea	beds, borders, massing		fertile, well-drained
Salvia			
Tagetes species	taller varieties at back of borders,		well-drained
Marigold	dwarfs for edging		
VINES:			
Clematis species	climbing walls, fences and arbors		well-drained, alkaline
Clematis (3-8)	(requires support)		
Lonicera japonica "Halliana"	climbing walls, fences, arbors;		average
Hall's Honeysuckle (4-9)	ground cover for slopes		
Parthenocissus quinquefolia	climbing walls, fences, arbors;		variety of conditions
Virginia Creeper (3-9)	ground cover for slopes		
Full Sun	Partial Shade	Full Shade	

HEIGHT	COLOUR	SEASON OF BLOOM	WORTH NOTING
15 cm - 1m (6 in. - 3 ft.)	silver foliage	not applicable	- 'Silver King' and 'Dusty Miller' best for ground cover
15 cm (6 in.)	white	spring - summer	- after blooming, shear off 2.5 cm from top of plant to promote new bloom
15 - 60 cm (6 in. - 2 ft.)	pink	late spring - early fall	- plant in dry, exposed location - does not tolerate heavy snow coverage
5 - 10 cm (2 - 4 in.)	white, pink, purple	spring	- plant centres may die out with age, at which time plant can be divided
5 - 25 cm (2 - 10 in.)	yellow, orange, pink	spring - fall	- prefers hot, dry locations in full sun
5 - 15 cm (2 - 6 in.)	white, pink, purple	spring - summer	- water only when plants are dry - after flowering, deadhead with shears to promote new bloom
5 - 6 cm (2 - 2.5 in.)	white, yellow, orange	summer - fall	- plants are considered poisonous
90 - 120 cm (3 - 4 ft.)	white, pink, rose, purple	summer - fall	- attracts birds and bees
25 cm - 1m (10 in. - 3 ft.)	pink, orange, red, white, yellow	summer - fall	- prefers hot, dry locations - water only when plants are dry
10 cm (4 in.)	yellow	summer - fall	- airy, trailing habit well suited to container planting
40 - 60 cm (16 - 24 in.)	gold, red, rose, pink	summer - fall	- prefer hot, dry locations - water only when plants are dry
30 cm - 2m (1 - 6 ft.)	white, yellow, orange, red purple	late summer - fall	- dwarf varieties available - taller varieties may require staking
20 - 60 cm (10 in. - 2 ft.)	pink, red, blue, white, purple	summer - fall	- heavy feeders, requiring regular fertilizing
15 - 90 cm (6 - 36 in.)	white, yellow, orange, red	summer - fall	- tolerate poor soil
1 - 7m (3 - 10 ft.)	pink, red, purple, blue, white, yellow	spring - fall (depending on variety)	- mulch well to keep roots cool
2.5 - 3.75m (8 - 12 ft.)	white	summer	- south or west exposure best - attracts hummingbirds
15 - 21m (50 - 70 ft.)	no flower; small bluish berries	leaves turn brilliant red in fall	- 23 cm in height as ground cover

WATER EFFICIENT CANADA

PLANT (Plant Hardiness Zone)

USE

EXPOSURE

SOIL

TREES AND SHRUBS:

Acer ginnala	accent tree for small lots or massed		well-drained,
Amur Maple (2-9)	on larger lots, informal hedge		alkaline
Caragana frutex 'Globosa'	poor soil areas, hedge,		variety of conditions
Globe Peashrub (2-9)	ground cover, climbing		
Catalpa speciosa	accent tree for large lot, shade tree		average
Western Catalpa (5-9)			
Elaeagnus angustifolia	can be grown as a tree or shrub		average
Russian Olive (2-9)			
Fraxinus pennsylvanica lanceolata	shade tree, boulevards, accent tree for large lots		variety of conditions
Green Ash (3-9)			
Gleditsia triacanthos	accent tree on large lot		average
Honeylocust (4-9)			
Juniperus species	rock gardens, slopes, banks,		well-drained
Juniper (2-9, depending on variety)	ground cover, foundation		
Malus species	accent and/or shade tree,		deep,
Crabapple (2-9)	group for large properties		well-drained
Pinus mugo pumilio	rock gardens, grouping, and		average
Mugho Pine (1-9)	dwarf planting for foundations		
Potentilla fruticosa	slopes, rock gardens		well-drained
Cinquefoil (2-9)			
Prunus virginiana (var. melanocarpa)	informal shrub borders		average
Chokecherry (2-9)			
Spirea x vanhouttei	informal shrub borders, accent		average, well-drained
Bridal Wreath Spirea (4-9)	plant, massing, foundation		
Quercus macrocarpa	shade tree, accent tree		average
Bur Oak (2-9)	on large lot		

ORNAMENTAL GRASSES:

Arrhenatherum elatius bulbosum	borders, massing		average, well-drained
Bulbous Oat Grass (4-9)			
Festuca ovina glauca	borders, edging, massing		average, well-drained
Blue Fescue Grass (4-9)			
Miscanthus sinensis	large borders, accent, massing		average, well-drained
Japanese Silver Grass (4-7)			
Pennisetum alopecuroides	borders, foundation, accent, massing		well-drained
Fountain Grass (5-9)			

Full Sun

Partial Shade

Full Shade

Note: Plant Hardiness Zones should be used as a general guide to plant selection. Depending on the conditions that exist around your property and on the degree of winter protection provided, plants may perform well outside of their typical zoned range. If there is a plant you like, it is worth experimenting with one specimen to see how it performs in your garden. Be sure to provide winter protection if you are in a lower Plant Hardiness Zone. For Plant Hardiness Zones in Canada, refer to Appendix 1.

HEIGHT	FOLIAGE COLOUR	WORTH NOTING
6m (19.7 ft.)	green; yellow, orange, red in fall	- protect from wind for better growth
1 - 1.2m (3 - 4 ft.)		- fast growing with foliage right to base
9m (29.5 ft.)	green; yellow in fall	- may be used as a substitute for Boxwood
7.5m (24.5 ft.)	silver-gray; yellow in fall	- fast growing, white flower early summer
20m (60 ft.)	green; gold in fall	- drought and salt tolerant, fragrant Russian Olive spring flowers
		- native to North America
		- provides winter food source for birds
11 - 17m (36 - 56 ft.)	light green; golden in fall	- rapid grower providing light, "dapple" shade
1 - 4.5m (3 - 15 ft.)	evergreen/silver/blue-gray	- height depends on variety
		- require full sun to maintain dense form
		- compact to upright varieties with varying heights
5 - 7.5m (16 - 25 ft.)	green; gold, orange, red, purple in fall	- pink or white flowers in spring depending on variety
1m (3 ft.)	evergreen	- drought tolerant once established (3 to 5 years)
30 cm - 1.5m (1 - 4 ft.)	green; yellow in fall	- yellow flowers spring through summer
		- hybrids are smaller with white or yellow flowers
4.5m (15 ft.)	green or purple; red or purple in fall	- white flower, small black fruit, tend to sucker
		- prune to single trunk for small tree
2 - 2.5m (6 - 8 ft.)	blue-green; yellow in fall, white flowers in spring	- tolerates dry to moist conditions
20m (66 ft.)	green; gold, orange in fall	- large, arching branches
		- drought tolerant once established (2 seasons)
		- decorative fruit
15 - 20 cm (6 - 8 in.)	green and white	- plants usually brown-out in July, cut back for new fall growth
25 - 30 cm (10 - 12 in.)	silvery-blue	- clump-forming habit
1.5m (5 ft.)	green with white stripe	- plumes of silvery-white blooms in fall
60 cm - 1m (2 - 3 ft.)	green	- does poorly in areas with very cold winters
		- plumes of cream or gold blooms in summer



WATER EFFICIENT CANADA

TURF GRASSES FOR CANADIAN LAWNS

GRASS TYPE	ZONES	DROUGHT TOLERANCE	DURABILITY	pH
Blue grama (W)	4 - 8	excellent	above average	slightly alkaline
Buffalo (W)	4 - 8	excellent	average	slightly alkaline
Canada Blue (C)	2 - 7	good	good	range
Chewings Fescue (C)	2 - 7	very good	average	slightly acidic
Creeping Red Fescue (C)	2 - 7	good	average	slightly acidic to neutral
Crested wheat (C)	2 - 7	very good	average	slightly alkaline

(C) - Cool-season grasses: grow best when daytime temperatures are cool (spring & fall) and have reduced growth in the heat of mid-summer, possibly going dormant.

(W) - Warm-season grasses: do best in the heat of mid-summer and do not green-up until June and become dormant, turning brown, in early fall.

* All turfgrass varieties listed do not tolerate water-saturated, heavy clay soils.

APPENDIX 3

SOIL TYPE*	SEEDING	MOWING HEIGHT	WORTH NOTING
sandy loam to clay loam	0.5 - 1 kg/100 sq. meter (1 - 2 lb./1000 sq. ft.)	8 cm (3 in.)	- as turf grass, up to 1,980 metres (6,500 ft.) elevation - excellent for full sun exposed lawns and to control erosion on slopes - does not tolerate shade or heavy winter foot traffic
sandy loam to clay loam	1 - 1.4 kg/100 sq. meter (2 - 3 lb./1000 sq. ft.)	5 - 8 cm (2 - 3 in.)	- as turf grass, up to 1,980 metres (6,500 ft.) elevation - full sun, does not tolerate humidity - turf thins with foot traffic, shade, water and fertilization
sandy loam to clay	0.5 - 1 kg/100 sq. meter (1 - 2 lb./1000 sq. ft.)	8 - 10 cm (3 - 4 in.)	- adapts to moist through dry soil conditions - tolerates poor soils - more adaptable and hardy than Kentucky Blue
sandy loam to clay loam	1.6 - 2.3 kg/100 sq. meter (3.5 - 5 lb./1000 sq. ft.)	5 - 8 cm (2 - 3 in.)	- full sun to partial shade; more tolerant of shade than Red Fescue - performs well in poor soil conditions
sandy loam to loam	1.6 - 2.0 kg/100 sq. meter (3.5 - 4.5 lb./1000 sq. ft.)	8 cm (3 in.)	- full sun to partial shade; well suited to cool, humid regions - performs well in poor soil conditions, does not tolerate wet soils - requires some irrigation during prolonged dry periods
sandy loam to clay loam	1.4 - 2.3 kg/100 sq. meter (3 - 5 lb./1000 sq. ft.)	8 cm (3 in.)	- as turf grass, up to 2,750 metres (9,000 ft.) elevation - for more informal applications where appearance is not major factor - full sun to partial shade

Mixtures of grass seeds are more durable, drought tolerant with greater resistance to weeds and pests. Talk to a lawn care professional at your local garden centre or consult the resources listed in Appendix 4, for best mixtures for your region.



WATER EFFICIENT CANADA

GRASS TYPE	ZONES	DROUGHT TOLERANCE	DURABILITY	pH
Dwarf Fescue (C)	3 - 9	very good	excellent	range
Hard Fescue (C)	3 - 8	very good	average	slightly acidic to neut
Kentucky Blue (C)	2 - 7	average	good	acidic to neutral
Perennial Rye (C)	3 - 7	average	very good	neutral
Tall Fescue (C)	2 - 7	very good	excellent	range

(C) - Cool-season grasses: grow best when daytime temperatures are cool (spring & fall) and have reduced growth in the heat of mid-summer, possibly going dormant.

(W) - Warm-season grasses: do best in the heat of mid-summer and do not green-up until June and become dormant, turning brown, in early fall.

* All turfgrass varieties listed do not tolerate water-saturated, heavy clay soils.

APPENDIX 3

SOIL TYPE*	SEEDING	MOWING HEIGHT	WORTH NOTING
silty loam to clay	2.7 - 3.6 kg/100 sq. meter (6 - 8 lb./1000 sq. ft.)	4 - 5 cm (1.5 - 2 in.)	- low winter hardiness - mix with Tall Fescue (60/40 ratio) - tolerates shade
sandy loam to clay loam	1.8 - 2.3 kg/100 sq. meter (4 - 5 lb./1000 sq. ft.)	5 - 8 cm (2 - 3 in.)	- good shade tolerance - slow growing, therefore reduced mowing requirements - do not over fertilize
silty loam to clay loam	0.5 - 1 kg/100 sq. meter (1 - 2 lb./1000 sq. ft.)	8 cm (3 in.)	- requires irrigation during dry periods - full sun to partial shade (less than 30 percent shade) - some newer varieties have improved drought and shade tolerance
sandy loam to clay loam	1.8 - 2.7 kg/100 sq. meter (4 - 6 lb./1000 sq. ft.)	8 cm (3 in.)	- tolerates shade (up to 60% shade) - cultivars 'Manhattan' and 'Manhattan II' varieties very durable - mix with Kentucky Bluegrass and fine fescue for best appearance
silty loam to clay	2.7 - 3.6 kg/100 sq. meter (6 - 8 lb./1000 sq. ft.)	10 cm (4 in.)	- as turf grass, up to 2,750 meters (9,000 ft.) elevation - damaged areas must be re-seeded or re-sodded to speed repair - full sun to partial shade

Mixtures of grass seeds are more durable, drought tolerant with greater resistance to weeds and pests. Talk to a lawn care professional at your local garden centre or consult the resources listed in Appendix 4, for best mixtures for your region.



WATER EFFICIENT CANADA

RESOURCES

WEB SITES

Water Efficiency - General

Canada Mortgage and Housing Corporation
<www.cmhc-schl.gc.ca>

Canadian Water and Wastewater Association
<www.cwwa.ca>

Environment Canada
<www.ec.gc.ca/water/en/manage/effic/e_weff.html>

United States Environmental Protection Agency
- Office of Water Management
<www.epa.gov/owm/genwave.htm>

Water Wiser (American Water Works Association)
<www.waterwiser.org>

For links to provincial, territorial and municipal water efficiency web sites, visit the Environment Canada site listed above.

Low-Water Landscaping

Internet Directory for Botany
<www.botany.net/IDB/subject/botmenu.html>

Canadian Botanical Conservation Network
<www.rbg.ca/cbcn/index.html>

North American Native Plant Society
<www.acorn-online.com/hedge/cws.html>

Prairie Turfgrass Research Centre
<www.oldscollge.ab.ca/ptrcscripts/homepage.ASP>

Canadian Soil Information System (CanSIS) of Agriculture and Agri-Food Canada
<<http://res.agr.ca/CANSIS/>>

Includes a soil database, maps (Plant Hardiness Zones of Canada), soil surveys, and related publications.



There are numerous garden clubs and associations across Canada that provide information on low-water landscaping and native plants. Key word search "water efficient gardening" and "xeriscaping" using a Canadian search engine. Links to web sites with information on water efficient gardening are also available through the Environment Canada web site listed above.

SUGGESTED READING

Low-Water Landscaping

Bennett, J.: Dry-land gardening: A xeriscaping guide for dry-summer, cold-winter climates. Firefly Books Ltd.; Ontario, CAN. 1998

Denver Water; Xeriscape Plant Guide. American Water Works Association, Fulcrum Publishing; Golden Colorado, USA. 1996

Johnson, Lorraine; Grow Wild: Native Plant Gardening in Canada. Random House; Canada. 1998.

O'Keefe, J.; Water-Conserving Gardens and Landscapes. Capitol City Press; Vermont, USA. 1992.

Schultz, Warren; The Chemical-Free Lawn. Rodale Press; Emmaus, Pennsylvania, USA. 1996.

Williams, Sara; Creating the Prairie Xeriscape. University Extension Press; University of Saskatchewan; Saskatoon, Saskatchewan, CAN. 1997.

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Page 44 (Perennial Rye Grass, Tall Fescue, Fine Fescue) - Warren Schultz

Page 45 (Sprinklers), Page 46 (Sprinkler Timer), Page 47 (Rain Barrel, Mulch), Page 49 (Grass),
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Other Useful Canada Mortgage and Housing Corporation Information Sources

The Clean Air Guide: How to Identify and Correct Indoor Air Problems in Your Home

The homeowner's first step to better air quality. This guide helps you evaluate air quality, identify contaminants and their sources and determine what corrective measures to take. Contains crucial information for people with asthma, allergies, respiratory diseases or environmental sensitivities. Includes a personal action plan.

Order # 6695E—\$5.95

Building Materials for the Environmentally Hypersensitive

There's no guide like this available in Canada. It is a practical sourcebook for people with environmental sensitivities, serious asthma or allergies. In an easy-to-use format, it includes 180 product listings and contains the most current information about building materials best suited for people with environmental sensitivities. Includes personal test instructions and a comprehensive index.

Order # 6742E—\$29.95

Healthy Housing Renovation Planner

This illustrated guide gives you information about materials and renovation methods that can improve your health and your home's efficiency. It contains tips for every room in your house and includes step-by-step guides, project planning worksheets to help reduce costs, and comparison charts to help you choose materials to create a healthier house.

Order # 2172E—\$34.95

FlexHousing: The Professional's Guide

Build your market share by building homes that can last a homebuyer a lifetime — FlexHousing. See how traditional design practices are adapted to put space to new and profitable use, from the basement to the attic. It's about building homes that can easily and economically be adapted to accommodate an in-law suite, a home-based office or wheelchair access. Includes illustrations, floor plans and sample costs.

Order # 2400E—\$24.95

FlexHousing: Homes That Adapt to Life's Changes

This consumer magazine is packed with information about FlexHousing features inside and outside the home. Richly illustrated with hundreds of colour photographs and detailed drawings, it shows you what FlexHousing is all about.

Order # 2020E—\$9.95

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